# The Migration and Exploitation of Chum Salmon Stocks of the Johnstone Strait-Fraser River Study Area, 1962-1970

A. D. Anderson and T. D. Beacham

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

September 1983

**Canadian Technical Report of Fisheries and Aquatic Sciences No. 1166**

nada

## Canadian Technical Report of Fisheries and Aquatic Sciences

These reports contain scientific and technical information that represents an important contribution to existing knowledge but which for some reason may not be appropriate for primary scientific (i.e. *Journal*) publication. Technical Reports are directed primarily towards a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries management, technology and development, ocean sciences, and aquatic environments relevant to Canada.

Technical Reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report will be abstracted in *Aquatic Sciences and Fisheries Abstracts* and will be indexed annually in the Department's index to scientific and technical publications.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Details on the availability of Technical Reports in hard copy may be obtained from the issuing establishment indicated on the front cover.

## Rapport technique canadien des sciences halieutiques et aquatiques

Ces rapports contiennent des renseignements scientifiques et techniques qui constituent une contribution importante aux connaissances actuelles mais qui, pour une raison ou pour une autre, ne semblent pas appropriés pour la publication dans un journal scientifique. Il n'y a aucune restriction quant au sujet, de fait, la série reflète la vaste gamme des intérêts et des politiques du Ministère des Pêches et des Océans, notamment gestion des pêches, techniques et développement, sciences océaniques et environnements aquatiques, au Canada.

Les Rapports techniques peuvent être considérés comme des publications complètes. Le titre exact paraîtra au haut du résumé de chaque rapport, qui sera publié dans la revue *Aquatic Sciences and Fisheries Abstracts* et qui figurera dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1-456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457-714, à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715-924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, Ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 925.

La page couverture porte le nom de l'établissement auteur où l'on peut se procurer les rapports sous couverture cartonnée.

Canadian Technical Report of

Fisheries and Aquatic Sciences No. 1166

September 1983

# THE MIGRATION AND EXPLOITATION OF CHUM SALMON STOCKS OF THE JOHNSTONE STRAIT-FRASER RIVER STUDY AREA, 1962-1970

by

A. D. Anderson[1] and Terry D. Beacham

Department of Fisheries and Oceans

Fisheries Research Branch

Pacific Biological Station

Nanaimo, British Columbia V9R 5K6

---

[1]Department of Fisheries and Oceans
Field Services Branch
60 Front Street
Nanaimo, British Columbia V9R 5H7

(c) Minister of Supply and Services Canada 1983

Cat. No. Fs 97-6/1166 ISSN 0706-6457

TABLE OF CONTENTS

Page

ABSTRACT . . . . . v

INTRODUCTION . . . . . 1

MATERIALS AND METHODS . . . . . 3
Tagging procedure and materials . . . . . 3
Tag recovery . . . . . 4
Organization of data . . . . . 4
Treatment of data . . . . . 5

RESULTS AND DISCUSSION . . . . . 5
Tags applied . . . . . 5
Tag intensity . . . . . 6
Recovery intensity . . . . . 6
Migrational routes and timing . . . . . 7
Routes . . . . . 7
Rates of migration, all stocks . . . . . 8
(a) From upper Johnstone Strait tag site . . . . . 8
(b) From lower Johnstone Strait tag site . . . . . 9
(c) From Texada Island tag site . . . . . 9
(d) Rate of migration between tag sites . . . . . 9
(e) Rate of migration between fishing areas . . . . . 10
(f) Areas of delay . . . . . 11
(g) Summary . . . . . 12
Rates of migration, stocks, and populations . . . . . 12
(a) Fraser River stock . . . . . 13
1. Lapsed days to Cottonwood . . . . . 14
2. Lapsed days to spawning ground dead recovery . . . . . 14
(b) Mid-Vancouver Island stock . . . . . 15
1. Lapsed days from Texada Island . . . . . 15
2. Lapsed days from Qualicum - Baynes Sound . . . . . 15
3. Rate of migration between tag sites . . . . . 16
Abundance of stocks . . . . . 17
(a) Spawning ground escapement by sub-area stock for week of entry into upper Johnstone Strait . . . . . 17
(b) Catch from single and mixed stock fisheries by week of entry into Statistical Area 12 . . . . . 18
(c) Occurrence and total abundance (catch plus escapement) of sub-area stocks by week of entry into Statistical Area 12 . . . . . 19
(d) Timing of sub-area stocks in upper Johnstone Strait . . . . . 19
1. Upper Johnstone Strait . . . . . 19
2. Lower Johnstone Strait . . . . . 20
3. Loughborough to Bute Inlet . . . . . 20
4. Mid-Vancouver Island . . . . . 20
5. Toba Inlet . . . . . 20
6. Jervis Inlet . . . . . 20

TABLE OF CONTENTS

Page

7. Lower Vancouver Island . . . . . 21
8. Southern Vancouver Island . . . . . 21
9. Howe Sound and Burrard Inlet . . . . . 21
10. Fraser River . . . . . 21
Abundance of major populations . . . . . 22
(a) Timing of major populations in upper Johnstone Strait . . . . . 22
1. Puntledge . . . . . 23
2. Big Qualicum . . . . . 23
3. Little Qualicum . . . . . 23
4. Nanaimo . . . . . 23
5. Cowichan . . . . . 23
6. Saltery Bay . . . . . 24
7. Squamish . . . . . 24
8. Cheakamus . . . . . 24
9. Stave . . . . . 24
10. Harrison . . . . . 24
11. Squakum . . . . . 25
12. Chehalis . . . . . 25
13. Vedder . . . . . 25
Exploitation . . . . . 25
Study Area . . . . . 25

ACKNOWLEDGMENTS . . . . . 26

LITERATURE CITED . . . . . 26

TABLES . . . . . 28

APPENDIX A . . . . . 57

APPENDIX B . . . . . 76

FIGURES . . . . . 97

## ABSTRACT

Anderson, A. D., and T. D. Beacham. 1983. The migration and exploitation of chum salmon stocks of the Johnstone Strait-Fraser River study area, 1962-1970. Can. Tech. Rep. Fish. Aquat. Sci. 1166: viii + 125 p.

Rates of migration and exploitation of chum salmon (Oncorhynchus keta) in the Johnstone Strait-Fraser River study area were investigated with a tagging program in 1962 and 1965-1970. A total of 48,375 chum salmon were tagged in the study area during this period, with major tagging areas in upper and lower Johnstone Strait, and minor ones in Bond-Knight Inlet, Texada Island, Qualicum-Baynes Sound, and Cowichan Bay. Over 30% of the tags applied were recovered, with 16.5% (7,980 tags) recovered from spawning grounds and 13.8% (6,691 tags) recovered from marine fisheries.

Tag recoveries indicated that upper Vancouver Island and Kingcome Inlet stocks leave the main migration route before entering lower Queen Charlotte Strait. Blackney Passage was the main entrance route of chum salmon to upper Johnstone Strait. Upper Johnstone Strait and Loughborough/Bute Inlet stocks leave the main migration route before entering Discovery Passage. The Toba Inlet stock did not separate from the main migration route until it reached at least northern Texada Island. There was little separation of stocks between lower Johnstone Strait and Texada Island. The middle Vancouver Island stock separated from the main migratory route by at least Qualicum-Baynes Sound.

Study Area chum salmon generally completed spawning and died within 5-8 wk after entering upper Johnstone Strait. The mean seasonal migratory period between the upper and lower Johnstone Strait tag sites was 4.4 days, which indicated an average rate of travel of 16 mi (25 km) per day. The average rate of passage for chum salmon between lower Johnstone Strait and Texada Island was 10 mi (16 km) per day. Chum salmon travelled at an average rate of 6 mi (10 km) per day between Texada Island and the southern Strait of Georgia. Chum salmon destined for Washington State migrated at a greater rate through the Study Area than did those stocks destined for the Study Area. There was a general tendency for early and middle timing populations (mid-September to mid-October) to travel through Johnstone Strait at rates greater than the seasonal average, whereas middle to late timing stocks travelled at rates less than the seasonal average.

The Fraser River stock was the most abundant of all stocks examined, comprising an average of 46% of all chum salmon migrating through Johnstone Strait during 1965-1970. The stock reached a peak of abundance in Johnstone Strait during late October.

Exploitation rates varied from a seasonal average of 6.3% in 1966 when there was no directed fishery on chum salmon to 47% in 1970. Highest rates of exploitation occurred in Johnstone Strait.

Key words: chum salmon, exploitation, Fraser River, Johnstone Strait, movement, tagging.

## RÉSUMÉ

Anderson, A. D. and T. D. Beacham. 1983. The migration exploration of chum salmon stocks of the Johnstone Strait-Fraser River study area, 1962-1970. Can. Tech. Rep. Fish. Aquat. Sci. 1166: viii + 125 p.

Les vitesses de migration et d'exploitation du saumon kéta (Oncorhynchus keta) dans le secteur d'étude détroit de Johnstone - fleuve Fraser ont été étudiés, grâce à un programme d'étiquetage, en 1962 et de 1965 à 1970. Un total de 48 375 saumons kétas one été étiquetés dans ce secteur au cours de cette période, les principaux endroits d'étiquetage étant situés dans les parties supérieure et inférieure du détroit de Johnstone et les moins importants dans les zones inlet Bond-Knight, détroit de Baynes-Qualicum, dans l'île Texada et la baie Cowichan. Plus de 30 % des étiquettes fixées ont été récupérées, avec 16,5 % (7 980 étiquettes) récupérées sur les frayères et 13,8 % (6 691 étiquettes) dans les pêches maritimes.

Les récupérations d'étiquettes ont montré que les stocks de la partie supérieure de l'île Vancouver et de l'inlet Kincrome quittent la route principale de migration avant de pénétrer dans la partie inférieure du détroit de la Reine-Charlotte. Le passage Blackney était la principale voie d'entrée du saumon kéta dans la partie supérieure de détroit de Johnstone. Les stocks de la partie supérieure du détroit de Johnstone et de l'inlet Loughborough/Bute quittent la route principale de migration avant de pénétrer dans le passage Discovery. Le stock de l'inlet Toba n'a pas quitté la route principale de migration avant d'avoir atteint au moins le nord de l'île Texada. Il y a eu peu de séparation de stocks entre la partie inférieure du détroit de Johnstone et l'île Texada. Le stock de la partie médiane de l'île Vancouver a quitté la route principale de migration au moins au niveau de la région détroit de Baynes-Qualicum.

De façon générale, les saumons kétas du secteur étudié frayaient et mouraient entre 5 et 8 semaines après avoir pénétré dans la partie supérieure du détroit de Johnstone. La période moyenne de migration saisonnière entre les lieux d'étiquetage des parties supérieure et inférieure de détroit de Johnstone a été de 4,4 jours, ce qui indique une vitesse moyenne de déplacement de 16 mi (25 km) par jour. La vitesse moyenne de passage du saumon keta entre la partie inférieure du détroit de Johnstone et l'île Texada a été de 10 mi (16 km) par jour. Le saumon kéta a voyagé à une vitesse moyenne de 6 mi (10 km) par jour entre l'île Texade et le sud du détroit de Géorgie. Les saumons kéta se rendant dans l'État de Washington ont traversé le secteur étudié à une vitesse plus grande que ne l'ont fait les stocks se rendant dans ce secteur. Les populations à migration précoce et moyennement précoce (de la mi-septembre à la mi-octobre) avaient généralement tendance à traverser le détroit de Johnstone à des vitesses plus grandes que la moyenne saisonnière, tandis que les stocks à migration moyennement tardive et tardive ont voyagé à des vitesses inférieures à la moyenne saisonnière.

Le stock de fleuve Fraser était le plus abondant de tous les stocks examinés, comprenant, en moyenne, 46 % de tous les saumons kéta qui sont passés par le détroit de Johnstone de 1965 à 1970. Le stock a atteint un maximum d'abondance dans le détroit de Johnstone à la fin d'octobre.

Les taux d'exploitation ont varié, passant d'une moyenne saisonnière de 6,3 % en 1966, alors qu'il n'y avait pas de pêche axée sur le saumon kéta, à une moyenne de 47 % en 1970. Les taux les plus élevés d'exploitation se sont produits dans le détroit de Johnstone.

Mots-clés: saumon kéta, exploitation, fleuve Fraser, détroit de Johnstone, déplacement, étiquetage.

# INTRODUCTION

Adult chum salmon destined to spawning streams tributary to the Johnstone Strait-Fraser River area (Study Area) approach their natal spawning grounds from the north through Queen Charlotte Strait and then on through Johnstone Strait (Fig. 1). For the purpose of management and analysis, the Study Area is divided into thirteen sub-areas (Fig. 2). Chum salmon destined to the spawning grounds within these sub-areas are referred to as stocks. In this report a stock is defined as a group of fish destined to a specific geographical area. Such stocks have been further sub-divided into populations based on their similarity of timing. A population is defined as a group of fish destined to a specific spawning ground (stream) and treated as a unit because of the similarities of destination and timing between the comprising members of that population. In total there are approximately 120 populations (streams) contributing to the chum salmon run through Johnstone Strait.

Chum salmon migrating through Johnstone Strait and Georgia Strait are subjected to several fisheries. The catch data is grouped into commercial fishing areas, according to the statistical areas implemented in 1929 (Fig. 3). The first major fishery on Study Area chum salmon occurs in Johnstone Strait (Statistical Areas 12 and 13), approximately 70 mi (110 km) in length, through which migratory chum salmon must pass enroute to their spawning grounds. Here chum salmon are concentrated during their total inshore migration distance and subjected to an intensive net fishery during this period of concentration. A limited seine and gillnet fishery operates in the northern and central sections of the Strait of Georgia (Statistical Areas 14, 15, 16, 17, and 18). Fisheries in the northern and central sections of the Strait of Georgia target mainly on local stocks. Fisheries in the Texada Island region of the Strait of Georgia target on mixed stocks. The next major fishery occurs in the Fraser River area (Statistical Area 29). This fishery includes the 50 mi of Fraser River downstream from Mission, the estuary and adjacent waters of the southern section of Strait of Georgia. The stocks fished are those mainly destined for the Fraser River. A United States gillnet and seine fishery also operates in the Point Roberts area, a few miles south of the Fraser River mouth. Chum salmon taken in this fishery are considered to be of Fraser River origin.

Chum salmon migrating through Johnstone Strait have been previously examined in four tagging studies since 1928. The studies reported by Pritchard (1929, 1931) and Chatwin (1953) examined the major migration route and exploitation rate of the total run. The study reported by Manzer (1954) was also concerned with the migratory behavior patterns and the exploitation of the component groups of the run. The tagging study reported by Walker et al. (1969) also examined the migratory behavior patterns and exploitation of these component groups.

Pritchard (1929, 1931) determined that chum salmon in upper Johnstone Strait migrate southeast to lower Johnstone Strait, with a major proportion destined for the mainland areas (mainly Fraser River) and a lesser proportion to Vancouver Island (mainly mid-Vancouver Island). Chatwin (1953) identified segments of the run in terms of occurrence and destination, and with limited data, the migrational rate for some run components. Average time

lapsed between tagging and recovery indicated a post-tagging delay in the area of tagging, and a migrational rate of 17-23 mi per day between upper Johnstone Strait and Discovery Passage tagging sites (a distance of 70 mi). The migrational rate of the Fraser River stock through the Strait of Georgia averaged 10 mi per day (a distance of 120 mi), including an indicated 7-day delay at the mouth of the Fraser River. Chatwin also calculated a minimum rate of removal for the season of 38% of the total run.

Manzer (1954) also identified the major stocks and calculated their migrational rates. Throughout the duration of the run, Manzer reported that several stocks migrated at different times, but none was completely separable in time. The migration rates determined by Manzer were comparable to those of Chatwin. In addition, different segments of a common stock displayed varying times of occurrence and rates of travel, suggesting that the stocks could be further sub-divided into populations for the purpose of management.

Manzer calculated a minimum seasonal rate of removal of 52%, representing an increase from 36% in 1945 and 38% in 1950. The intensity of the fishery was at a minimum during the early and late parts of the season and at a maximum during the peak migration of middle October. The occurrence of increased catches in Johnstone Strait was correlated with the occurrence of major stocks. Manzer concluded that different groups were utilized to varying degrees by virtue of their timing, with those migrating during the early and late season exploited to a lesser extent than those migrating during the peak fishery. Manzer noted that because of the migrational rates and distribution of the fisheries, it was conceivable that some stocks were subjected to successive and perhaps excessive rates of exploitation.

Walker et al. (1969) noted differences in the times of occurrence of various populations and that these populations could be separated in time to a greater degree than the stock which they composed. This tagging study indicated a minimum of 36 populations migrating during the major duration of the run and as many as 12 during a single day. Average lapsed time between tagging and recovery for different segments of a given stock varied. In general the lapsed time decreased for later migration members. A notable exception were those populations destined for the Fraser River, in which progression towards an increase in lapsed time occurred. This increased lapsed time occurred as a result of an increased period of delay at the mouth of the Fraser River. The recapture rates for the separated tagging periods varied, the rates being directly related to the lapsed time of each tagged group. Walker et al. (1969) concluded that different rates of exploitation were a direct result of the pattern in which the commercial fisheries operated, and that repeated exploitation of a population, commencing in Johnstone Strait and continuing throughout the migration route, was likely.

Manzer noted that chum salmon stocks in Johnstone Strait migrated at different times, although none was completely separable in time, and that such stocks were harvested to varying degrees by virtue of their migratory behavior patterns and the distribution of the successive fisheries within the study area. Walker et al., noting differences in the migratory behavior patterns of the populations, concluded that the populations could be separated on a time basis to a greater degree than the stock which they comprised and that a greater balance between catch and escapement could be achieved when management was based upon this smaller unit of productivity.

The accumulation of migratory behavior information up to and including 1962 identified the potential of fisheries management of the chum salmon based on a stock concept. However, the formulation of the required management policies that would provide for efficient harvesting and protection of particular chum populations in relationship to their varying productivities required additional migratory behavior information. During 1965 to 1970 an extensive tagging program on adult chum salmon was conducted within Johnstone Strait and the Strait of Georgia. The purpose of this program was to determine the migratory behavior patterns of discrete populations of chum salmon indigenous to the Johnstone Strait-Fraser River area in order to provide a real time management basis for the fishery. This report summarizes timings of the major chum salmon stocks through Johnstone Strait, outlines the pattern of exploitation, and summarizes the knowledge obtained from the previously mentioned tagging program.

## MATERIALS AND METHODS

### TAGGING PROCEDURES AND MATERIALS

Chum salmon marked in the study were captured by chartered purse seines manned by their regular crews and employing their usual fishing methods. Captured chum salmon were held in the bunt section of the seine net alongside the vessel. Two or three chum salmon at a time were lifted to the deck and placed in tagging troughs. The tag was affixed, fork length and estimated sex recorded, and the scales taken. The length, sex, and scales were taken from the first 100 chum salmon tagged each day. The chum salmon were not anesthetized during tagging. The average air exposure time approximately only 45 sec. In general three sets were made on each tagging day. If a large catch was made in one set, only a portion of that catch was tagged. Chums that were scaled, bleeding, or in any such manner unsuitable tagging subjects, were released untagged.

The standard salmon tag used in this study was a Peterson disk of trilaminated cellulose acetate. The numbered disk (one alphabetical and five numerical characters) displayed a return address and indicated a reward. The numbered disks and unnumbered baffles were of different colours, with the unnumbered baffles also incorporating varying shapes. These variations allowed a tagged fish to be identified to a tagging location and time without actual physical recovery of the fish. All tags were attached by nickel pins (0.035 in shank diameter) inserted through the musculature below the anterior portion of the dorsal fin.

In 1962, 9/16 in (14 mm) diameter disks, 0.042 in thick were used. Between 1965 to 1970, 7/8 in (23 mm) diameter disks, 0.049 in thick were used, and a transparent buffer disk (1/4 in (6 mm) diameter, 0.049 in thick) was added to the nickel pin outside the numbered disk, reducing potential tag loss resulting from disk failure (Lister and Harvey 1969).

In 1962, tagging was not carried out one day preceding, during, nor one day following a fishery. During 1965 to 1970, tagging was conducted by the seine test fishing crew in Johnstone Strait during any non-net fishery day.

## TAG RECOVERY

The tagging programs were advertised throughout the industry and rewards for recaptured tags were offered. Tag recovery from the industry was facilitated principally through tag return envelopes distributed by Fisheries Service personnel. In 1962 a reward of fifty cents, and in 1965 forward a reward of one dollar was paid for each recovery. Routine catch sampling was instituted to increase the yield of tag from the commercial fisheries.

In conjunction with the Johnstone Strait tagging programs, chum salmon were also tagged in the Fraser River system as part of a spawning ground enumeration study (Palmer 1972). A major portion of the Johnstone Strait tags recovered from the Fraser River resulted from this enumeration study. A major portion of the recoveries from Big Qualicum River resulted from routine enumeration studies. The recovery effort for these two locations remained relatively constant between years and constitutes the minimum recovery effort employed in 1965 and 1966. Spawning ground tag recovery crews were employed during 1968 in the mid-Vancouver Island sub-area. They were also employed during 1962, 1967 and 1969 in the middle, lower, and southern sub-areas of Vancouver Island and Howe Sound. For years and areas for which the field crews were not operative, spawning ground recoveries were dependent upon public returns and/or Fisheries Service personnel engaged in routine escapement surveys. In 1970 maximum spawning ground recovery effort was employed, where field crews were employed in all thirteen sub-areas of the study area.

## ORGANIZATION OF DATA

Using a numerical coding system for tag and recovery areas and a Julian dating system, we tabulated tag recoveries by area and week of tagging. The mean and variance of lapsed time from tagging to recovery were calculated for these groups. Some tag recoveries had incomplete information. Recoveries for which no recovery area was known were eliminated from further analysis. Spawning ground tag recoveries with a lapsed time greater than 90 days or marine tag recoveries greater than three standard deviations beyond the mean of a comparable group were not used in the subsequent calculations of medians, modes and means.

The edited recoveries were then divided into three groups: those from the marine locations (commercial fisheries mainly), those from spawning grounds dead fish, and those from live fish. These groups were summarized for each area where tagging was conducted by: week of tagging for each area of recovery, by recovery areas for each week of tagging, and for all

taggings by area of recovery by week. For the lapsed time of tag recoveries obtained from spawning grounds, the means and variances were tested by analysis of variance.

## TREATMENT OF DATA

To determine the migratory behavior patterns of chum salmon within the Study Area, we used only those recovered tags for which a recovery location was given and considered reliable. We also calculated lapsed times between tagging and recovery in terms of means. However, the mean as a measure of central tendency is unduly affected by the large values of a few individuals. The lapsed times of a few tagged fish were abnormally large, perhaps due to the effects of tagging and errors in reporting or recording. Those spawning-ground tag recoveries with lapsed times greater than 90 days and those marine recoveries with lapsed times greater than three deviations beyond the comparable group mean were not used in the calculations of the lapsed times. The tendency for the mean to become normally distributed through increasing the sample size by combining the data for within and between years, is demonstrated by comparing the differences between the median and mean with the limits of the standard error for all grouped data. As normal probability distributions are associated with the mean lapsed time, it can be easily adjusted for different tagging intensities.

The duration of time between the occurrence of tagging and commercial fishing periods in Johnstone Strait varied during the study (Fig. 4). In general, tagging was carried out during any non-commercial day. The duration of time between the occurrence of tagging and commercial recovery affects the lapsed times. For example, chum salmon tagged three days before a fishery would have a greater lapsed time than those tagged only one day before the fishery. However, enough variations occurred in the durations between tagging and the occurrence of commercial recovery periods that it is assumed by combining the lapsed time estimates for all tag weeks and all tag years these variations would be normally distributed and the effects would be self-cancelling.

# RESULTS AND DISCUSSION

## TAGS APPLIED

A total of 48,375 chum salmon were tagged in the Johnstone Strait and Georgia Strait areas during 1962 and 1965 to 1970, inclusive. Major taggings were conducted in upper Johnstone Strait (Malcolm Island-Backfish Sound sub-area where 25,367 tags were applied in 114 tagging days) and in lower Johnstone Strait (Deepwater Bay area where 11,590 tags were applied in 49 tagging days). Minor taggings were conducted in the Bond-Knight Inlet

(430 tags), Texada Island (1,824 tags), Qualicum-Baynes Sound (8,764 tags), and Cowichan Bay (400 tags) areas. Of the tags applied, 30.3% (14,671) were recovered; 16.5% (7,980) on the spawning grounds, and 13.8% (6,691) marine recoveries (Table 1). Spawning ground recoveries encompassing 66 rivers and creeks were recorded from all 13 sub-areas. By sub-areas, the major proportion of these recoveries were from Jervis Inlet, middle and lower Vancouver Island, Howe Sound, and the Fraser River. By spawning grounds, the main recovery areas were Puntledge, Big and Little Qualicum, Saltery Bay, Stave, Harrison and Vedder. The marine recoveries, reflecting the occurrence and intensity of commercial fishing, were mainly in the upper and lower Johnstone Strait and southern Georgia Strait areas (Table 1). Recovery rates of tags for weekly tagging are indicated for tags applied in upper Johnstone Strait (Table 2) and lower Johnstone Strait (Table 3).

## TAG INTENSITY

The total number of tags applied was limited by two factors; the availability of fish, and crew size. A higher proportion (tagging intensity) of the weekly run was tagged during periods when the availability of chum salmon was limited than during periods when the crew size was limited. To quantify the weekly tagging intensities in upper Johnstone Strait, we related the weekly tag totals to the relative weekly abundance as indicated by the weekly catch per unit of effort. For example, the catch per unit of effort for Statistical Areas 12 and 13 was assigned to the middle date for that fishing period, giving a successive number of relative abundances for both statistical areas for specific dates. To obtain a continuous measure of weekly abundance for Statistical Area 12, we backdated those of Statistical Area 13 by four days. Four days was found to be the seasonal mean for rate of travel between the Area 12 and 13 tagging sites. This composite of relative weekly abundances was divided into standardized tagging weeks. The weekly tag totals were divided by the weekly CPUE in order to determine a unit of tags applied for each unit relative abundance (Table 4).

## RECOVERY INTENSITY

The effort expended on annual spawning ground tag recovery programmes varied. However, the portions of tags recovered varied little from year to year, therefore no adjustment was made for the different recovery effort. From a common tagging location, the proportions of marine tags recovered varied, reflecting different annual exploitation rates (Table 5; Fig. 5). The portions of spawning ground tag recoveries did not vary, and indeed remained relatively constant regardless of the varied exploitation rates and spawning ground recovery effort. For tags applied in the Alert Bay area during 1965 to 1970, the percent of marine recovery of tags ranged from 2.7 to 25.9%, whereas the spawning ground recoveries ranged from 9.0 to 11.4% (Table 1). In 1965 and 1966 the recovery effort for both the spawning grounds and marine areas was minimum (the study areas being closed for the specific

harvesting of chum salmon) and resulted in a 9.2 and 9.0% recovery of tags from the spawning grounds, and a 3.3 and 2.7% marine recovery rate. The maximum spawning ground and marine recovery effort was in 1970. During this year the Study Area rate of exploitation was 40.5%, the highest for 1962 to 1970, and tag recovery crews were employed in all 13 sub-areas. This recovery effort resulted in a 11.4% spawning ground recovery rate, and a 25.9% marine recovery rate of the tags applied in the Alert Bay area.

## MIGRATIONAL ROUTES AND TIMING

### ROUTES

Chum salmon migrating from the oceanic rearing areas to the Study Area have access from the south through Juan de Fuca Strait and or from the north through Queen Charlotte Strait. The catch data indicate that the Study Area chum salmon approach from the north. The chum salmon catch in the intensive salmon fisheries of Juan de Fuca Strait is comparatively minimal and the timing does not coincide with the catch and timing of the chum salmon fisheries of Johnstone Strait. No tagging studies have been conducted in the Juan de Fuca area to establish that there is no significant southern approach to the Study Area. Study Area chum salmon migrate largely by the common approach route through Queen Charlotte Strait.

The distribution of chum salmon within the Study Area by their migration routes has been indicated by the dispersal of tags from the tagging areas (Table 6). A small percentage of tags was recovered to the northwest of all tag sites. A reversal of migrational direction has been observed by all the authors reporting on chum salmon taggings within the Study Area. Northwest migrations of pink salmon have been noted in Georgia Strait by Vernon et al. (1964), and they indicated that pink salmon that approached the Study Area through Juan de Fuca Strait could migrate northwest through Georgia Strait. This result could explain the northwest migration of some tagged chum salmon, although it seems reasonable to assume that the northern approach is by far the major one used in returning Study Area chum salmon.

The migration route of chum salmon entering the Study Area is to the southeast from Queen Charlotte Sound (Fig. 6-10). Chum salmon leaving Queen Charlotte Strait do so to enter the spawning streams of upper Vancouver Island and Kingcome to Knight Inlet sub-areas or to proceed southeast through Johnstone Strait. Since none of the tags applied at the Malcolm Island-Blackfish Sound tagging sites was recovered from the upper Vancouver Island and Kingcome Inlet sub-areas, it must be assumed that the upper Vancouver Island and Kingcome Inlet sub-area stocks leave the main migration route before entering lower Queen Charlotte Strait. The upper Johnstone Strait tag site yielded recoveries from Bond/Knight Inlet sub-area, indicating that at least a portion of this stock leaves the main migration route in the

lower Queen Charlotte Strait area. Taggings in the Bond/Knight Inlet area indicate that at this point, the Bond/Knight Inlet sub-area stock is well separated from the main migration route.

The main migration leaves lower Queen Charlotte Strait to pass southeast into upper Johnstone Strait. During the 6 yr of tagging in upper Johnstone Strait (Malcolm Island-Blackfish Sound sub-area) a greater degree of success in capturing chum salmon for tagging was achieved from the tagging sites around Blackney Passages (between Hanson and Harbledown-West Cracroft Island), indicating that Blackney Passage was the main entrance route to upper Johnstone Strait.

The migration route is then to the southeast through Discovery Passage and into Strait of Georgia. Tag recoveries from the lower Johnstone Strait tagging sites resulted in only minimal marine and no spawning ground recoveries above this area, indicating that the upper Johnstone and Loughborough/Bute Inlet sub-area stocks leave the main migration route before entering Discovery Passage. Additionally, recoveries from Toba Inlet indicate that this sub-area stock did not separate from the main migration within Discovery Passage and was still with the migration at least to northern Texada Island tagging locations.

Spawning ground tag recoveries from the Texada Island tag site indicate that there was very little separation of the stocks leaving Discovery Passage and destined to adjacent and southern spawning grounds. The percent of tags recovered by sub-areas from the lower Johnstone Strait and Texada Island tagging locations indicates that the percent stock composition of the run changed very little and indeed was virtually the same for stocks destined to middle and lower Vancouver Island, and Jervis Inlet (Table 6). Spawning ground tag recoveries from the Qualicum-Baynes Sound taggings indicate that the middle Vancouver Island stock had at this location separated from the main migration route. Limited returns from the Cowichan tagging site also indicated that the southern Vancouver Island stock was separate from those of the Fraser River and Howe Sound regions.

## RATES OF MIGRATION, ALL STOCKS

### a) From upper Johnstone Strait tag site

The Study Area chum salmon have generally completed spawning and die within 5-8 wk after entering upper Johnstone Strait. The seasonal mean lapsed time from tagging in upper Johnstone Strait to spawning ground, dead recovery for all years was 46.8 days for all stocks (Appendix Table A1). However, the seasonal mean lapsed times for 1965 and 1966 are not representative because of the small sample sizes for both years and delayed recovery during 1966 on the Fraser River system. Additionally, the lapsed times for tag weeks ending September 23 and November 11 and 18 for all years are not representative because of small sample sizes during the start of the season and the reduced or terminated recovery effort during the end of the season. If the data for

years 1965 and 1966 is excluded, and for all weeks ending September 23 and November 11 and 18, the mean lapsed time from tagging at upper Johnstone Strait to spawning ground dead recovery was 47.1 days (Table 7).

For years 1967 to 1970 the individual weekly mean lapsed times ranged from 39.4 days for the week ending September 30 in 1967 to 52.1 days for the week ending October 28 in 1970 (Table 7). This range in mean lapsed times can be explained in terms of a changing population composition with each population displaying a characteristic rate of migration. Previous authors (Palmer 1972; Walker et al. 1969; Manzer 1954; and Chatwin 1953) demonstrated that the chum salmon run migrating through Johnstone Strait was composed of a number of different populations, separable to some degree by their timing and rates of migration. The composition of the run would change during each season in relation to timing and population abundance. Thus differences in the weekly and seasonal mean lapsed times would exist by virtue of the changes in the weekly and yearly abundance of populations that display different timing and rates of migration.

(b) From lower Johnstone Strait tag site

The mean lapsed time from tagging in lower Johnstone Strait to spawning ground dead recovery for years 1962, 1967, and 1969 for weeks ending September 23 to November 18 was 42.5 days (Table A2). The weekly mean lapsed times for weeks ending September 23, September 30 and November 18 for all years are not considered representative because of the small samples sizes during the start of the season and the reduced or terminated recovery effort during the end of the season. If the data from these weeks are excluded, the mean lapsed time from tagging at lower Johnstone Strait to spawning ground dead recovery was 42.7 days (Table 8).

The mean lapsed times for individual weeks from upper Johnstone Strait (Table 7) displayed the same pattern as those from lower Johnstone Strait. For the first 3 wk the lapsed times remained relatively constant from both tag sites. Lapsed time increased for the weeks ending October 21 and October 28 from upper Johnstone Strait and for weeks ending October 28 and November 4 from lower Johnstone Strait. Lapsed time decreased for subsequent weeks from both tag sites. This pattern indicates that those stocks entering upper Johnstone Strait after the week ending October 14 have slower rates of migration than those entering previously.

(c) From Texada Island tag site

Tagging at Texada Island occurred for just the latter half of the season for 1 yr only. The mean lapsed time from tagging to spawning ground dead recovery during 1970 for weeks ending October 28 to November 11 was 41.4 days (Table 9).

(d) Rate of migration between tag sites

The seasonal migratory rates of all stocks combined between successive tag sites are indicated by the differences between the mean lapsed

times recorded in Tables 7, 8, and 9. The rate of migration between sites determined from these lapsed times will not be biased because of the continual and coincident tag release from the tag locations and the subsequent recovery under common conditions. Any bias incorporated in the mean lapsed times from the individual tag sites will be of the same value, hence the rate of migration between the tag sites obtained by subtraction would not incorporate this bias.

The mean seasonal migratory rate between the upper and lower Johnstone Strait tagging sites was 4.4 days (Table 10). The approximate distance between the two tag sites is 70 mi, thus a seasonal average rate of travel of 16 mi per day is indicated. The majority of commercial net fishing for chum salmon in Statistical Areas 12 and 13 occurs between the upper Johnstone Strait tag site and the Deepwater Bay tag site (the southern section of Discovery Passage is closed to commercial net fishing south of Seymour Narrows). Hence the mean seasonal migratory rate of 4.4 days describes the period during which the average chum salmon was available to the fishing fleet in the Johnstone Strait area of Areas 12 and 13. On a weekly basis, the rate of migration varies from 5.2, 4.7, 4.7, 4.0, 5.6, to 3.4 days for the respective 6 wk. These rates of migration reflect the rate of migration of that group of fish which was most abundant for that week.

The Texada Island tag site data comprised the latter half of the season for 1 yr only. The mean seasonal migratory rate from upper Johnstone strait to Texada Island was 8.4 days (Table 10). Of the 8.4 days, 4.4 days lapsed between the upper and lower Johnstone Strait tag sites, and 4.0 days between the lower Johnstone Strait and Texada Island tag sites. The distance between the lower Johnstone Strait and Texada Island tag sites approximates 40 mi; thus an average rate of travel of 10 mi per day is indicated.

(e) Rate of migration between fishing areas

Additional estimates of the migratory rates can be determined from the lapsed times of tagging to marine recovery along the migration route (Table A4). In this situation median lapsed times were used, the median being the least affected by the discontinuous nature of the occurrence and intensity of the marine recovery effort.

Median lapsed times, for all stocks combined, to succeeding fishing areas were estimated from the three tag sites (Table 11). These three estimates (i.e. from different tag sites to a common marine recovery location) differed from each other by 1-6 days. The lapsed times from the upper Johnstone Strait tag site to succeeding fishing areas were probably the most accurate because these data encompassed an additional year of tagging and a greater total number of recoveries. Median lapsed times from the upper Johnstone Strait tag site to the succeeding fishing areas of lower Johnstone Strait, north and central, and southern Strait of Georgia were 5, 9, and 9 days, respectively (Table 11). The best estimate of lapsed time from the upper to lower Johnstone Strait fishing areas of 5 days is comparable to that of 4.4 days (Table 10) for between tag sites.

The best estimate of lapsed time from the lower Johnstone Strait to the north and central Strait of Georgia fishing areas was 9 days. The distance between the two fishing areas approximates 70 mi and indicates a seasonal average rate of travel of 8 mi per day. Recall that the lapsed time between the lower Johnstone Strait and Texada Island tag site was 4.0 days (Table 10) and that the distance between the two tag sites was 40 mi. Therefore, of the 9 days lapsed time from the lower Johnstone Strait to the north and central Strait of Georgia fishing areas, it can be assumed that 4 days lapsed between the lower Johnstone Strait and Texada Island tag sites. Thus 5 days were required to traverse the remaining 30 mi from the Texada Island tag site to the southern limit of the central section of the Strait of Georgia fishing area, indicating a seasonal average rate of travel of 6 mi per day. The best estimate of lapsed time from the north and central to southern Strait of Georgia fishing areas was 9 days. The distance between the two areas is approximately 55 mi and indicates a seasonal average rate of travel of 6 mi per day.

One point of comparison is the lapsed times of those chum salmon stocks destined to Washington State. Median lapsed time from upper Johnstone Strait to marine recovery in the Bellingham area and south (i.e. not including that of Point Roberts) was 17 days (Table 11), 6 days less than the shorter migration to the southern Strait of Georgia. Median lapsed time from the lower Johnstone Strait tag site was 16 days. The difference in the median lapsed times from the upper to lower Johnstone Strait tag sites was 1 day, which indicates a seasonal average rate of travel of 70 mi per day through the Johnstone Strait area. The distance from lower Johnstone Strait to the Bellingham area is 160 mi, which indicates a seasonal average rate of travel of 10 mi per day. The median lapsed time from the Texada Island tag site, which encompasses 1 yr only and for just the latter half of the season, was 8 days and indicates a rate of travel of 15 mi per day. Thus it is apparent that the chum salmon stocks destined for Washington State travel at a greater rate through the Study Area than those stocks destined for the Study Area.

(f) Areas of delay

The duration of delay of the migrating stocks can be determined by the range of lapsed times over which the recoveries occurred. Assuming that the marine recoveries for all years combined were normally distributed, we determined the duration of delay from the relative cumulative frequencies of recoveries. In this study, the occurrence and intensity of the marine recovery was discontinuous, thus for a given year the range of lapsed times may not adequately describe the total duration of delay, nor indeed the area. However, by combining the tag years, we found that the yearly differences in the occurrence and intensity of the recovery periods would tend to be self-cancelling and the lapsed times would approach a normal distribution.

The mean and ranges of lapsed times from tagging at the three tag sites to marine recovery in all areas are summarized in Table 12. Plus or minus 1.64 and 0.67 standard deviations from the mean lapsed times describes the 90 and 50% (number of days symmetrical around the mean) portions of the duration of migration. The durations of migration calculated from the marine recoveries from the upper and lower Johnstone Strait tag sites were similar for comparable marine recovery areas. The durations of migration calculated

from the Texada Island tag site marine recoveries were less than those from the upper and lower Johnstone Strait tag sites. This was a result of the time relationship between the occurrence of tagging and subsequent marine recovery.

The durations of migration calculated for the Johnstone Strait area indicates that 7.7 days were required for the middle 50% of a given segment of the chum salmon run entering upper Johnstone Strait to pass the southern limit of commercial fishing in Statistical Area 13, and that 16.2 days are required for the middle 90%, or an additional 8.5 days for the additional 40% (Table 12). The durations of migration calculated from both the upper and lower Johnstone Strait tag sites indicate that both the north and central and southern Strait of Georgia are areas of comparable delay. The recoveries from the two combined areas of Statistical Areas 14, 15, 16, 17, 18, 29 indicate that an average of 12.8 days are required for the middle 50% of a given segment of the chum salmon run to clear the commercial areas of the Strait of Georgia and that 30.4 days are required for the middle 90%, or an additional 17.6 days for the additional 40%.

(g) Summary

Migrating chum salmon entering upper Johnstone Strait show a decrease in their rate of travel from the Johnstone Strait area to that of the Strait of Georgia and a subsequent increase in the duration of delay. The seasonal average rate of travel for the Study Area stocks was estimated at 16 mi per day in Johnstone Strait, 10 mi per day in the northern section of Strait of Georgia, and 6 mi per day in the central and southern section of the Strait of Georgia. The duration of migration for the middle 50% passage was estimated at 7.7 days in Johnstone Strait, 12.3 days in the north and central Strait of Georgia, and 13.0 days in the southern Strait of Georgia. The comparable rates and durations of migration for the Strait of Georgia indicate that the Strait of Georgia is an area of delay for all stocks destined to the adjacent spawning grounds.

Stocks destined for areas outside the Strait of Georgia (i.e. Washington State) showed a greater rate of migration through the total Study Area. The seasonal rate of migration for the stocks destined to Washington State was estimated at 70 mi per day through the Johnstone Strait area, and through the Strait of Georgia at 10 mi per day. However, it is probable that delayed migration near or within the marine areas adjacent to natal spawning grounds is a phenomenon common to all chum salmon stocks, including those of Washington State.

## RATES OF MIGRATION, STOCKS AND POPULATIONS

An important consequence of different rates of migration for chum salmon populations migrating through a common fishery is the different rates of exploitation on those populations. The exploitation rate, in part a function of time, would be greatest on those populations having slower than average rates of travel. The seasonal mean lapsed time between upper and

lower Johnstone Strait for all stocks has been estimated at 4.4 days (Table 10). Comparable estimates for chum salmon populations destined for areas adjacent to the Strait of Georgia for which at least 60 tags were recovered from the two tag sites are summarized in Table 13, and indicate that not all stocks nor populations migrate through the main fishing area of Johnstone Strait at the same rate. Stocks migrating through Johnstone Strait at a rate comparable to the average of 16 mi per day (i.e. lapsed time of 4.4 days) are those of middle and southern Vancouver Island, Howe Sound and Fraser River. The Jervis Inlet stock migrates at a greater rate than the average, the lower Vancouver Island stock at less than the average rate of 16 mi per day (Table 14).

Those populations that migrate through Johnstone Strait at rates equal to the average of 16 mi per day were: Squakum, Harrison, Little Qualicum, and Vedder. The populations of Squamish, Puntledge, Chehalis, Saltery Bay and Stave migrated through Johnstone Strait at rates greater than the average, whereas those of Cheakamus, Big Qualicum and Nanaimo at less than the average rate of 16 mi per day (Table 14). The populations which migrate through Johnstone Strait at rates greater than the average are those of early to middle timing (from mid-September to mid-October). Those populations which migrate at less than the average rate of travel are those of middle to late timing. The exception to this generalization is the Nanaimo River population, which displays a rate of travel less than the average but is early in its timing in Johnstone Strait.

For those populations for which the mean lapsed times between upper and lower Johnstone Strait tag sites were less than the average, the lapsed times between lower Johnstone Strait to spawning ground dead recovery were greater than the average, and vice versa (Tables 14 and 15). The Saltery Bay and Cheakamus populations were exceptions to this. Although the lapsed time between the upper and lower Johnstone Strait tag sites for the Saltery Bay populations was less than the average, the lapsed time between lower Johnstone Strait and spawning ground dead recovery was also less than the average. The lapsed times for the Cheakamus population was greater than the average in both cases.

(a) Fraser River stock

The Fraser River chum salmon stock is characterized by multi-populations, and indeed perhaps by a multi-racial structure, each displaying differences in migratory and spawning behavior patterns. Walker et al. (1969) and Palmer (1968) demonstrated that not only the populations comprising the Fraser River stock differed in their time of occurrence in Johnstone Strait, but that the main branch, side channels, and tributary sections of the Harrison-Chehalis population also differed in their time of occurrence, suggesting a multi-racial structure.

Walker et al. (1969) and Palmer (1972) observed a seasonal progression towards an increase in lapsed time from release in Johnstone Strait to entry into the Fraser River and concluded that this was a combination of reduced travel speed and increased estuarial residence for the later stocks. By dividing the duration of occurrence of the Fraser River stock in upper Johnstone Strait to that which occurred before and after

October 15, Palmer (1972) determined that the lapsed times after October 15 from Johnstone Strait was 4-5 days greater to river entry (at Cottonwood), and 4-12 days greater to spawning ground dead recovery than that before October 15. Tagging studies within the Fraser River system reported by Todd (1965) and Palmer (1972) also demonstrated an increased lapsed time for the late migrating stocks, and that this pattern was particularly evident for the Harrison River systems where the lapsed times from the Silverdale tag site differed by as much as 5 days for the late stocks. Palmer (1972) concluded that a slower migrational rate and/or increased estuarial delay was characteristic of the late migrating stocks.

Palmer (1972) also reported that the timing on the spawning grounds of the Chehalis-Harrison system varied considerably, the populations consisting of a mixture of early, middle, and late spawning segments. Palmer classified the Chehalis population as early to middle timing and the Harrison as middle to late timing. However, in some years owing to the varying relative seasonal abundance of the different groups of chum salmon, distinct peak periods of spawning were nullified. With such diversities in the migratory and spawning patterns of the Fraser River populations and the fluctuation within and between the seasonal abundance of the racial groups, the number of permutations in the migratory and spawning patterns are great.

1. Lapsed days to Cottonwood

The most consistent sampling source in occurrence and intensity for marine recoveries was the test-fishing operation conducted at Cottonwood Drift on the lower Fraser River (Statistical Area 29-B). This chartered gillnet test-fishing operation was conducted under standardized conditions to determine an index of abundance of chum salmon during migration. The technique was described by Todd (1965) and reviewed in detail by Palmer (1972).

The seasonal mean lapsed times to recovery at Cottonwood from tagging at upper and lower Johnstone Strait was 23.7 and 20.2 days, respectively (Table 16). The difference in lapsed times between the two tag sites of 3.5 days was not significantly different from that of 4.4 days estimated in Table 12 ($P>0.20$). The lapsed time for tags applied after October 15 at the upper and lower Johnstone Strait to Cottonwood were 4.2 and 5.9 days greater than those applied before October 15. Thus the late segment of the Fraser River stock which occurs in Johnstone Strait after October 14 migrates at a slower rate from lower Johnstone Strait to Cottonwood and at a slower total rate than the earlier segment. The migratory rate through the Strait of Georgia (a distance of 130 mi) was 8 mi per day for the earlier segment and 6 mi per day for the later segment.

2. Lapsed days to spawning ground dead recovery

The differences in mean lapsed times to spawning ground dead recovery between time periods and tag sites (Table 17) show the same pattern as those to Cottonwood (Table 16). However, additional information in terms of populations is apparent. The Stave and Squakum River populations, early to middle timing, have completed their entry into Johnstone Strait by mid-October. For the Harrison River population, the mean lapsed times from tagging at upper and lower Johnstone Strait to spawning ground dead recovery

was 48.4 and 40.2 days, respectively, for tags applied to October 14, and 51.9 and 47.8 days, respectively, for tags applied after October 14 (Table 17). The differences between the period lapsed times from both tag sites of 3.5 and 7.6 days were significantly different from each other ($P<0.05$). Thus for late segment of the Harrison River population (occurring in Johnstone Strait after October 14) a lapsed time between the upper and lower Johnstone Strait tag sites of 4.1 days is indicated as compared to 8.2 days for the early segment.

(b) Mid-Vancouver Island Stock

The populations of the mid-Vancouver Island stock show different rates of migration through Johnstone Strait (Table 14). The seasonal mean lapsed days through Johnstone Strait was 1.3 days for Puntledge, 5.1 days for Little Qualicum, and 9.1 days for Big Qualicum. However, the seasonal mean lapsed days from tagging at lower Johnstone Strait to spawning ground dead recovery for these populations were not significantly different for each other (Table 15). Additional tagging programs were conducted at Texada Island and Qualicum-Baynes Sound to identify the migratory behavior patterns of these populations in the Strait of Georgia.

1. Lapsed days from Texada Island

The tagging at Texada Island encompasses 1 yr only and for just the latter half of the migratory season. Some caution must be applied in interpreting these data as representative of the total season and for all seasons. The mean number of days from tagging at Texada Island to spawning ground dead recovery for the mid-Vancouver Island stock was 40.3 days (Table 18). The time for the Big Qualicum population was 44.0 days, and for Little Qualicum 35.6 days.

2. Lapsed days from Qualicum-Baynes Sound

The seasonal mean lapsed days from tagging at Qualicum-Baynes Sound to dead recovery on the spawning grounds of mid-Vancouver Island sub-area for both 1967 and 1969 combined was 28.1 days (Table 19). The seasonal mean time for 1969 was approximately 20% less than that of 1967. This difference should not be interpreted as differences in annual migratory behavior patterns. If the populations present in the Qualicum-Baynes Sound area during any time were tagged in proportion to their abundance, the reduced lapsed time for 1969 can be explained in terms of greater numerical dominance of the Big Qualicum River population in 1969. The seasonal mean lapsed time for the Big Qualicum population was 23.6 days (Table A15) or 4.5 days less than the mean of 28.1 days for all populations. The abundance of the population present in Qualicum-Baynes Sound would be equal to the escapements (i.e. no commercial fishing occurred Qualicum-Baynes Sound). The escapement to Big Qualicum River comprised 29% of the sub-area escapement in 1967, and 43% in 1969, so that annual differences in mean lapsed time were due to annual differences in relative abundance.

The duration of lapsed time within the Qualicum-Baynes Sound area for the mid-Vancouver Island sub-area populations is available from Walker and Lister (1965). In 1961 tagging was conducted within a one-half mile radius of the Big Qualicum River estuary to define arrival and delay times of chum

salmon. The authors defined the arrival times in terms of visual observations and the catch success of the tagging vessel. The extent of delay was determined by observations of daily tagged color combinations passing over a counting fence 2,300 ft above tidewater. Walker and Lister determined that the first significant migration of chum salmon into the estuary area occurred by the week ending November 11, with the first major accumulation by the week ending November 18. From then to the week ending December 6 chum salmon were readily available in the estuary. The seasonal mean lapsed days from tags applied within the estuary to spawning ground dead recovery was 23 days (Table 20). The seasonal mean lapsed time from tagging to visual observation at the fence was 9.2 days. Observations from the fence to tidewater indicated that no significant delay occurred in the lower section of the river. Thus the duration of seasonal delay for the Big Qualicum population in the estuary area was 9.2 days.

The seasonal mean lapsed days derived from tagging in 1967 and 1969 from the Qualicum-Baynes Sound area to spawning ground dead recovery was 28.1, 31.5, 23.6, and 31.2 days for the mid-Vancouver Island sub-area stock and its population of Puntledge, Big Qualicum and Little Qualicum, respectively (Table 21). If the seasonal spawning ground lifespan of 13.8 days (Table 20) is applicable to all mid-Vancouver Island populations, the duration of delay in the Qualicum-Baynes Sound area would be 14.3, 17.7, 9.8, and 17.4 days for mid-Vancouver Island sub-area stock and its populations of Puntledge, Big Qualicum and Little Qualicum, respectively.

The lapsed days from tagging at Big Qualicum estuary and at Qualicum-Baynes Sound to spawning ground dead recovery at Big Qualicum was 23 days for 1961 and 23.6 days for 1967 and 1969. The linear distance of tagging during 1961 did not exceed 1 mi, but during 1967 and 1969 the linear distance of tagging exceeded 60 mi. A 13.8 day spawning ground lifespan occurred in 1961 (Table 20) and 12.7 days for 1962 and 1965 to 1970 (Table 22). A duration of delay in the tagging areas of 9.2 to 10.9 days is indicated and implies an area of delay equal to that area of Qualicum to Baynes Sound and not specifically that of the estuary alone.

### 3. Rate of Migration between Tag Sites

The rates of migration between tag sites are indicated by the difference between lapsed time from successive tag sites. The mid-Vancouver Island sub-area stock migrates through Johnstone Strait in 5.3 days, and is within the "open gulf area" of the Strait of Georgia for 15.1 days after leaving lower Johnstone Strait and before localizing along the Qualicum-Baynes Sound shore. The stock is localized along the Qualicum-Baynes Sound shore for 15.4 days after leaving the "open gulf area" of the Strait of Georgia and before entering the spawning grounds (Table 22). The main populations of Puntledge, Big Qualicum, and Little Qualicum show differences in their migratory rates. The Puntledge population migrates through Johnstone Strait in 1.3 days, is within the "open gulf area" of the Strait of Georgia for 11.3 days, and is within the Qualicum-Baynes Sound area for 18.8 days. Times for the Big Qualicum populations were 9.1, 16.8, and 10.9 days for these areas respectively, and for Little Qualicum 5.1, 12.1, and 18.5 days, respectively.

Walker and Lister (1965) reported that there was a reduction in the weekly lapsed times from tagging to fence passage (Table 20), which indicates a reduction of delay for the weekly segments during the progression of the run. For the Big Qualicum population, the duration of delay ranged from 15.9 days for the week ending November 11 to 5.3 days for the week ending December 2. A similar occurrence for the mid-Vancouver Island stock is evident from the tagging programs of 1967 and 1969 (Table 23). Lapsed days from tagging to dead recovery (Table 22) and the days of spawning ground lifespan (Table 20) indicates a seasonal delay in the Strait of Georgia of 29.4 days of which 15.1 days occurred in the "open gulf area" and 15.4 days occurred in the Qualicum-Baynes Sound area changed with the progression of the run. The duration of delay for the early, middle and late segments for the stock ranged form 3.8, 11.2 to 18.3 days, respectively, in the "open gulf area" and from 28.9, 18.3 to 9.8 days, respectively, in the Qualicum-Baynes Sound area.

This reciprocal relationship of delay for the early, middle, and late segments between the "open gulf area" and Qualicum-Baynes Sound areas of the Strait of Georgia is characteristic of the Big and Little Qualicum population, but not for the Puntledge population (Table 23). For Puntledge, the delay in the "open gulf area" was 8.2, 9.7, and 9.5 days for the early, middle and late segments, respectively, whereas in Qualicum-Baynes Sound, the delay was 23.3, 16.6 and 21.2 days. The early, middle, and late segments of the Big Qualicum population showed a progressively greater duration of delay in the "open gulf area" ranging from 9.5, 15.6 to 16.4 days to a reciprocal reduction of delay in the Qualicum-Baynes Sound area ranging from 22.3, 11.3, to 9.2 days. The Little Qualicum population displayed a similar progression of delay.

## ABUNDANCE OF STOCKS

The abundance of individual stocks and populations is best described in terms of their changing weekly numbers as indicated by the relation of the escapement and catch to upper Johnstone Strait for the week of entry. Because many steps were involved in the determination of the abundance with time for each stock each year, the mechanics of the process are best described by examples of the actual computations for 1970.

### (a) Spawning ground escapement by sub-area stock for week of entry into upper Johnstone Strait

The first step was relating the seasonal spawning ground escapement back to upper Johnstone Strait for week of entry by apportioning the escapement in relation to the weekly number of upper Johnstone Strait tags recovered from the sub-area's spawning grounds. This was done by adjusting the weekly number of tags recovered from each sub-area's spawning grounds for 1970 (Appendix Tables B3), adjusted to a standard tagging intensity (Table 4), and then apportioning the seasonal sub-area's spawning ground escapement (Fraser 1970), into weeks of entry into upper Johnstone Strait in relation to the adjusted number of recovered tags.

(b) Catch from single and mixed stock fisheries by week of entry into Statistical Area 12

The second step was the assignment of seasonal catches to those occurring from single or mixed stock fisheries, and then relating these catches to Statistical Area 12 by week of entry. In 1970, the fishery in Johnstone Strait accounted for 73% of the study area catch, and the other mixed stock fishery at Texada Island accounted for less than 7%. All other fisheries, operating on single stocks, accounted for 20% of the Study Area catch. The catches from the Fraser River and the Point Roberts fishery were assigned to the Fraser River sub-area stock. The catches from the single stock fisheries of Statistical Areas 15, 17 and 18 were assigned to the sub-area stocks of Toba Inlet, lower Vancouver Island, and southern Vancouver Island, respectively. The catches from the single stock fisheries of Goletas Channel, Kingcome and Wakeman inlets, and Thompson, Bond, and Knight inlets were assigned to the sub-area stocks of upper Vancouver Island, Kingcome Inlet, and Bond to Knight inlets, respectively. The catches from the mixed stock fisheries of upper Johnstone Strait, lower Johnstone Strait, and Texada Island were not assigned to sub-area stocks at this juncture.

The seasonal catches from the single and mixed stock fisheries of the Johnstone Strait area and southeast were related to Statistical Area 12 by week of entry in the same manner as for the seasonal spawning ground escapements. Each fishery was assumed not to fluctuate in its recovery rate of tagged fish for each fishing period within a season. Such fluctuations would occur as a result of change in gear composition, proportion of seines to gillnets, and/or if the behavior pattern of the tagged and untagged fish changed during the seasonal fishing periods. The seasonal catches of each fishery southeast of the Johnstone Strait area were apportioned into weeks of entry into upper Johnstone Strait in relation to the number of tags, adjusted to a standard tagging intensity (Table 4), recovered from that fishery for that week of tagging. The seasonal catch from the lower Johnstone Strait fishery was related to weeks of entry into Area 12 by back-dating each weekly catch by 1 wk, 1 wk approximating the required time that the majority of fish entering upper Johnstone Strait would clear the southern limit of commercial net fishing in Area 12. We related the seasonal catch from the upper Johnstone Strait and the Malcolm-Broughton Island fishery to weeks of entry into Area 12 by assigning the catch from each fishery to the week in which it was caught. The seasonal catches from Goletas Channel and the Area 12 mainland inlet fisheries were minimal and generally occurred as incidental catches before the main chum fishery occurred. The seasonal catches from these fisheries were related to weeks of entry into Area 12 by assigning them to week of which they occurred.

Assigning the weekly catches of the mixed stock fisheries to a sub-area stock required the determination of the sub-area stock composition in each mixed stock fishery on a weekly basis. To determine these compositions, we summed the escapements for each week and each sub-area stock, related by week of entry into upper Johnstone Strait, seaward through the single stock fisheries, also related by week of entry into upper Johnstone Strait, along the general migration routes (Fig. 6-11) to the mixed stock fisheries. The mixed stock catches, related by week of entry into upper Johnstone Strait, were then apportioned in relation to the product of the seaward summations, and added to the appropriate sub-area stock.

(c) Occurrence and total abundance (catch plus escapement) of sub-area stocks by week of entry into Statistical Area 12)

The occurrence and total abundance (catch plus escapement) of sub-area stocks by week of entry into Statistical Area 12 for years 1965 to 1970 was estimated by the previously outlined procedures. The abundance of each of the sub-area stocks of upper Vancouver Island and Kingcome Inlet could not be determined because these stocks left the main migration route prior to the tagging site. Additionally, the abundance for the week ending September 16 includes a portion of catch not assigned to any particular stock. This early unassigned catch totalling from 7-12% of the annual Study Area catch for years during 1967 to 1970 occurred predominantly in Area 12 and would be from local stocks.

The first sub-area stocks of chum salmon to occur in Area 12 were the local stocks of upper Vancouver Island, Kingcome Inlet and Bond to Knight inlets, and the lower Vancouver Island stock. These stocks were followed by those of lower Johnstone Strait and the Fraser River. By the week ending October 7, all sub-area stocks, with the exception of upper Johnstone Strait, were present in Area 12 (Fig. 12). The sub-area stock of upper Johnstone Strait occurred by the week ending October 28. By the week ending November 4, the sub-area stocks of Jervis Inlet and Howe Sound had completed their occurrence. During the last two weeks of the migration ending November 11 and 18, four stocks still occurred in Area 12; those of upper Johnstone Strait, mid-Vancouver Island, southern Vancouver Island, and Fraser River. The last sub-area stock present in Area 12 was the local upper Johnstone Strait stock.

(d) Timing of sub-area stocks in upper Johnstone Strait

The timing, weekly occurrence, and abundance of the sub-area stocks entering the study area is best described in terms of their changing weekly abundance and composition (Table 24). The following description outlines the average timing of the different chum salmon stocks during the 1965 to 1970 migrations. The timing of each sub-area stock is described in reference to entry into upper Johnstone Strait in three ways. The first is its relative timing to other study area stocks, the second is its weekly abundance expressed as a percent of its total seasonal abundance, and the third its weekly abundance expressed as a percent of that total weekly abundance of all stocks.

1. Upper Johnstone Strait

The late timing sub-area stock of upper Johnstone Strait first occurred during the week ending October 28, and continued for the remainder of the season. This stock reached its peak abundance during the week ending November 11. During this week it comprised approximately 18% of the weekly abundance. During the week ending November 18, chum salmon from upper Johnstone Strait comprised approximately 25% of the weekly total chum abundance.

2. Lower Johnstone Strait

The sub-area stock of lower Johnstone Strait, of early to middle timing, first occurred in upper Johnstone Strait the week ending September 23 and continued to the week ending October 14. This stock reached its peak abundance during the weeks September 30 and October 7. During this 2-wk period its abundance comprised approximately 2% of weekly composition.

3. Loughborough to Bute Inlet

The Loughborough to Bute Inlet sub-area stock, mainly of middle timing, first occurred in the week ending September 30, and continued to the week ending October 21. This stock reached its peak of abundance during its first 2 wk of occurrence ending September 30 and October 7. During this period of peak abundance, it comprised approximately 14 and 12%, respectively, of weekly compositions.

4. Mid-Vancouver Island

The mid-Vancouver Island sub-area stock, mainly of middle and late timing, first occurred during the week ending September 23 and continued for the remaining migrational season to the week ending November 18. This stock reached its peak of abundance during the 2 wk ending October 21 and 28. During this period of peak abundance it comprised approximately 25 and 29% of weekly compositions. During the period of the week ending October 7 to the week ending from November 18, a period describing the main migrational time for this stock, the sub-area's stock's weekly abundance comprised a minimum of 11% of weekly composition. The mid-Vancouver Island sub-area stock was the second most abundant stock, totalling approximately 18% of the total seasonal abundance of all study area stocks entering and migrating through Johnstone Strait.

5. Toba Inlet

The Toba Inlet sub-area stock, mainly of middle timing, first occurred during the week ending September 30 and continued to the week ending October 28. This stock had two separate weeks of peak abundance. The first peak occurred during the week ending October 7 when it comprised approximately 6% of weekly composition, and the second occurred during the week ending October 21 when it comprised approximately 4% of weekly composition.

6. Jervis Inlet

The Jervis Inlet sub-area stock, mainly of middle to late timing, first occurred during the week ending September 23 and continued to the week ending November 11. This stock reached peaks of abundance during weeks ending October 14 and 21. During this period it comprised approximately 7% of weekly composition. The Jervis Inlet stock was the fifth most abundant stock, totalling approximately 5% of the total seasonal abundance of all chum salmon entering and migrating through Johnstone Strait.

7. Lower Vancouver Island

The lower Vancouver Island stock, mainly early and middle timing, first occurred during the week ending September 16 and continued to November 4. This stock reached peaks in abundance during the weeks ending September 30 and October 7. During these weeks it comprised approximately 9 and 7%, respectively, of weekly compositions. The lower Vancouver Island sub-area stock was the first stock to occur in Johnstone Strait of those destined to the areas of Johnstone Strait and southeast. During the first week of occurrence, it comprised approximately 74% of weekly compositions and during the second week, approximately 20%.

8. Southern Vancouver Island

The southern Vancouver Island sub-area stock, of middle to late timing, first occurred during the week ending September 30 and continued to the week ending November 11. This stock reached peaks of abundance during the weeks of October 21 and 28. During this 2-wk period it comprised approximately 13% of weekly compositions. The southern Vancouver Island stock was the third most abundant stock, comprising approximately 9% of the total seasonal abundance of all study area stocks entering and migrating through Johnstone Strait.

9. Howe Sound and Burrard Inlet

The Howe Sound and Burrard Inlet sub-area stock, mainly of middle to late timing, first occurred during the week ending September 23 and continued to the week ending November 11. This stock reached peaks of abundance during the 3 wk ending October 14, 21, and 28. During this period of peak abundance, the stock comprised approximately 9, 7 and 8%, respectively, of weekly compositions. The Howe Sound and Burrard Inlet stock has been the fourth most abundant stock, comprising approximately 6% of the total seasonal abundance of all study area stocks entering and migrating through Johnstone Strait.

10. Fraser River

The Fraser River sub-area stock, although predominately of middle and late timing, first occurred during the week ending September 23 and continued for the remainder of the season's migrational period. This stock tended to reach peak abundances during the weeks of October 21 and 28. However, a broad plateau of abundance, ranging from approximately 12-17%, occurred during the weeks ending September 30 to November 4, a period of 6 wk. During the weeks of main abundance, October 21 and 28, this stock comprised approximately 40 and 42%, respectively, of weekly compositions, this being the minimum of its weekly compositions. During its weeks of first and last occurrences, weeks ending September 23 and November 18, it comprised approximately 73 and 62%, respectively, of weekly compositions. The Fraser River stock has been the most abundant stock, comprising approximately 46% of the total seasonal abundance of all Study Area stocks entering and migrating through Johnstone Strait.

## ABUNDANCE OF MAJOR POPULATIONS

The occurrence and abundance of the major populations entering the study area may be shown, in the same manner used for describing the stocks, in terms of their changing weekly abundance. However, instead of determining changing weekly abundances on an annual basis, each population's weekly abundance was determined as a composite of that week for all years (Table 25).

In the previous session, in relating the sub-areas' seasonal spawning ground escapement to upper Johnstone Strait for week of entry, we apportioned the seasonal escapement in relation to the weekly number of upper Johnstone Strait tags recovered, adjusted for a weekly tagging intensity. The population's weekly escapement and the recovered tags are components of the sub-areas' weekly escapement and recovered tags. As such, the population's escapement can be determined by the relation of the number of tags recovered from the population to that of its sub-area, and as well the population's component catch can be determined in relation to the proportion of the population's weekly escapement to that of its sub-area.

The 1965 to 1970 composite of each week's escapement and its adjusted number of tags was determined by the summation of that week's escapement and its adjusted number of tags for each year. The total of each week's composite escapement and adjusted tags equals the sum of the 6-yr seasonal escapement and its adjusted tags. By dividing the sums of the 6-yr escapement by the sum of the 6-yr adjusted number of tags, we obtained a quotient describing a seasonal unit of escapement for each seasonal unit of adjusted tags. This quotient was divided into the composite escapement for each week and yields composite number of adjusted tags recovered for each week. The summation of the 6-yr seasonal escapement for each major population of the sub-area was apportioned into weekly escapements in relation to the composite number of adjusted tags recovered each week from the sub-area's spawning grounds. A 6-yr composite of each week's catch from the sub-area's stock was determined by the summation of that week's catch for all years. This composite catch was apportioned into that catch from a population in relation to population's weekly escapement to the sub-area's weekly escapement.

### (a) Timing of major populations in upper Johnstone Strait

The timing, weekly occurrence, and abundance of the major populations entering the study area is best described in terms of the changing weekly abundance and composition. A composite summary of the data from years 1965 to 1970 is presented in Table 26 and Fig. 13. The timing of each population is presented in comparison to its sub-area. Each is described in reference to entry into upper Johnstone Strait in its relative timing to other populations, and also to its weekly abundance expressed as a percent of its total seasonal abundance, and lastly to its weekly abundance expressed as a percentage of that total weekly abundance for that sub-area.

1. Puntledge

The Puntledge River population, mainly of middle timing, first occurred during the week ending September 23 and continued to the week ending November 11. This population reached its peak abundance during the week ending October 21. During this peak it comprised approximately 20% of its sub-area's abundance. On a seasonal basis, it comprised approximately 16%. In general, the timing of Puntledge is similar to that of the Little Qualicum River population.

2. Big Qualicum

The Big Qualicum River population, mainly of late timing, first occurred during the week ending October 7 and continued to the week ending November 18. This population reached its peak abundance during the week ending October 28. During this peak it comprised approximately 52% of its sub-area's abundance. On a seasonal basis, it comprised approximately 38% of the abundance of the mid-Vancouver Island stock.

3. Little Qualicum

The Little Qualicum River population, mainly of middle to late timing, first occurred during the week ending September 23 and continued to the week ending November 11. This population reached its peak abundance during the week ending October 21. During this peak, it comprised approximately 38% of its sub-area's abundance. On a seasonal basis it comprised approximately 33%. In general, the timing of Little Qualicum is similar to that of the Puntledge River population.

4. Nanaimo

The Nanaimo River population, of early to middle timing, first occurred during the week ending September 16 and continued to the week ending October 28. This population had reached a plateau of abundance during three consecutive weeks ending September 30, October 7 and 14. During its plateau of abundance, it comprised approximately 60, 80 and 92% of its sub-area's abundance. On a seasonal basis, it comprised approximately 66% of the lower Vancouver Island stock. The Nanaimo River population is the first major population to occur in Johnstone Strait of those destined to areas of Johnstone Strait and southeast.

5. Cowichan

The Cowichan River population, of middle to late but predominately late timing, first occurred during the week ending October 7 and continued to November 11. This population reached its peak abundance during the week ending October 28. During this peak, it comprised the vast majority of its sub-areas' abundance. On a seasonal basis, it comprised approximately 75% of the southern Vancouver Island stock. The weekly percent composition listed for the last 3 wk of its occurrence are within a limit of error, and the Cowichan population comprised the total abundance of the southern Vancouver Island stock during this period.

6. Saltery Bay

The Saltery Bay Creek population, of middle to late timing, first occurred during the week ending September 30, and continued to the week ending November 11. This population reached its peak of abundance during the week ending October 21. During this peak it comprised approximately 20% of the Jervis Inlet stock abundance. On a seasonal basis, it comprised approximately 22%.

7. Squamish

The Squamish River population, mainly of middle timing, first occurred during the week ending October 7, and continued to the week ending November 4. This population reached its peak abundance during the week ending October 21. During this peak, it comprised approximately 72% of the sub-area's abundance. On a seasonal basis, it comprised approximately 46%. The Squamish population, although comprising a greater percent of the sub-areas seasonal abundance than the Cheakamus River, the other major population of the sub-area, has a shorter duration of occurrence in upper Johnstone Strait.

8. Cheakamus

The Cheakamus River population, of middle to late timing, first occurred during the week ending September 30 and continued to the week ending November 11. This stock reached a plateau of abundance during the three consecutive weeks ending October 14, 21, and 28. During this plateau of abundance, it comprised approximately 31, 31, and 35%, respectively, of its sub-area's abundance. On a seasonal basis, it comprised approximately 31% of stock abundance.

9. Stave

The Stave River population, of early to middle timing, first occurred during the week ending September 23 and continued to the week ending October 28. This stock reached a general peak of abundance during the week ending October 7. During the peak it comprised approximately 34% of its sub-area's abundance. On a seasonal basis, it comprised approximately 17%. During the first 4 wk of occurrence, September 23 to October 14, the Stave River population comprised from approximately 25-34% of the Fraser River stock's weekly abundance.

10. Harrison

The Harrison River population, of middle to late, but predominately late timing, first occurred during the week ending September 23, and continued for the remainder of the season's migration. This stock reached a peak of abundance during the week ending October 28. During this period it comprised approximately 42% of its sub-area's abundance. On a seasonal basis, it comprised approximately 31%. Of the sub-area's weekly abundance, the Harrison River's abundance ranged from approximately 18% during its initial 2 wk of occurrence to approximately 67% during its final 2 wk.

11. Squakum

The Squakum River population, of middle timing, first occurred during the week ending September 30, and continued to the week ending November 4. This stock reached peak abundance during the week ending October 7. During this period it comprised approximately 9% of the sub-area's abundance. On a seasonal basis, it comprised approximately 3%.

12. Chehalis

The Chehalis River population, of early and middle timing, first occurred during the week ending September 23 and continued to the week ending November 11. This population reached peak abundance during the week ending September 30. During this peak it comprised approximately 15% of its sub-area's abundance. On a seasonal basis, it comprised approximately 7%.

13. Vedder

The Vedder River population, mainly of middle-to-late timing, first occurred during the week ending September 23 and continued to the week ending November 11. This population reached peak abundance during the week ending October 28. During this peak, it comprised approximately 30% of its sub-area's abundance. On a seasonal basis, it comprised approximately 20%. The weekly abundances of the Vedder River population are composed of approximately 20% of its sub-area's abundance throughout its occurrence.

## EXPLOITATION

### STUDY AREA

Exploitation may be expressed as a percent removal (i.e., the catch as a percent of the total seasonal abundance). During 1965 and 1966 no specific exploitation of the study area stocks was permitted. However, during these 2 yr, as a result of the incidental catches during the early part of the season, the seasonal percent exploitation was 7.8 and 6.3%, respectively (Table 27). During 1967 to 1970, the seasonal exploitation rate of study area stocks was 23.2, 33.5, 37.1 and 47%, respectively. Seasonal exploitation of the individual stocks has varied by virtue of their migratory behavior patterns and through management practices of providing specific protection to various stocks.

On the other hand, exploitation may be expressed in terms of the individual fisheries' effectiveness as indicated by the regional exploitation rate (i.e., the percent of all fish entering a fishing area during the season which were caught in that area). Of all chum salmon passing through Queen Charlotte Strait and entering the Study Area, 0.8% was destined to the upper Vancouver Island sub-area. This group was fished in Goletas Channel at an intensity of 46.5% (Table 28). The average seasonal abundance destined to

Kingcome Inlet and Bond to Knight inlet sub-areas averaged 1.5 and 5.1%, respectively, of all chum salmon entering the study area. The exploitation rate of these groups was 28.3 and 23.5%, respectively. The average seasonal abundance of chum salmon destined to enter Johnstone Strait was 92.6% of the total entering the Study Area. There was 12.2% of the abundance of chum salmon initially entering the Study Area removed in upper Johnstone Strait. The commercial fishery accounted for 87.5% of these removals. The commercial fishery in lower Johnstone Strait accounted for 72.9% of all losses in that area. The Study Area seasonal abundance remaining to enter the Strait of Georgia averaged 66.1% of the initial size. Those stocks destined to the mid-Vancouver Island, Toba Inlet, and Jervis Inlet sub-areas averaged 18.5% of the initial abundance. On the average this abundance was fished at a 5.4% exploitation rate in local fisheries. Those stocks destined to the sub-areas of lower Vancouver Island, southern Vancouver Island and Howe Sound averaged 13.9% of initial abundance. This group was fished at an exploitation rate of 4% in local fisheries. The portion of the initial study area seasonal abundance remaining and destined to the Fraser River averaged 33.7%. This group was fished in the local fishery at an exploitation rate of 22.7%. It is apparent that most of the catch of Study Area chum salmon during 1965 to 1970 was derived from Johnstone Strait, with the remainder derived mainly from the Fraser River (Fig. 14).

## ACKNOWLEDGMENTS

We are indebted to Mr. R. N. Palmer and Mr. F. J. Fraser for their supervision and co-ordination of the tagging program during 1965-1970. Mr. M. D. Bailey assisted greatly in the preliminary data analysis and computer programming. Mr. A. W. Argue provided many valuable comments on an initial draft of the manuscript. The final version of the manuscript was prepared with the assistance of the staff at the Pacific Biological Station.

## LITERATURE CITED

Chatwin, B. M. 1953. Tagging of chum salmon in Johnstone Strait 1949 and 1950. Bull. Fish. Res. Board Can. 96: 1-33.

Fraser, F. J. 1970. The 1970 report on chum salmon stocks of the Johnstone Strait-Fraser River study area, and prospects for 1970. Can. Dept. Fish. Forest. Fish. Serv. Pac. Reg. Tech. Rep. 1970-6. 20 p.

Lister, D. B., and R. A. L. Harvey. 1969. Loss of Petersen disk tags from spawning chum salmon (Oncorhynchus keta). Can. Fish. Cult. 40: 33-40.

Manzer, J. I. 1954. Pink and chum salmon studies during 1953; Johnstone Strait tagging. Western Fish 47(6): 21, 64.

Palmer, R. N. 1968. Report on the status of the even-year pink salmon stocks and of the chum salmon stocks of the Johnstone Strait study area, and on the prospects for 1968. Can. Dept. Fish., Vancouver. 31 p.

1972. Fraser River chum salmon. Canada Fisheries Service, Pacific Region, Tech. Rep. 1972-1, 284 p.

Pritchard, A. L. 1929. The tagging of chum salmon, 1928. Prog. Rep. Pac. Biol. Stat. 3: 9.

1931. The tagging of pink and chum salmon in British Columbia in 1929. Prog. Rep. Pac. Biol. Stat. 9: 13-14.

Todd, I. 1965. Fraser River chum salmon investigation 1964. Can. Dept. Fisheries, Vancouver, 31 p.

Vernon, E. H., A. S. Hourston, and G. A. Gulland. 1964. The migration and exploitation of pink salmon runs in and adjacent to the Fraser River convention area in 1959. Int. Pac. Sal. Fish. Comm. Bull. 15: 1-296.

Walker C. E., and D. B. Lister. 1965. Big Qualicum River biological assessment studies, 1961-1962. Can. Dept. Fish. Vancouver, B.C., Manuscript Report, 46 p.

Walker, C. E., D. B. Lister and R. A. L. Harvey. 1969. Migration of chum salmon from lower Johnstone Strait to Strait of Georgia and tributary streams, 1962. Can. Dept. Fish. and Forest, Pacific Region. 30 p.

Table 1. Annual number of chum salmon tagged and recovered in the Johnstone Strait-Fraser River study area for years 1962, and 1965 to 1970.

| Year | Tagging location | Number tagged | Number recovered | | |
|---|---|---|---|---|---|
| | | | Spawn ground | Marine | Totals |
| 1962 | Deepwater Bay | 3,415 | 322 (9.4) | 477 (14.0) | 799 (23.4) |
| 1965 | Alert Bay | 1,614 | 148 (9.2) | 53 (3.3) | 201 (12.5) |
| 1966 | Alert Bay | 1,680 | 151 (9.0) | 45 (2.7) | 196 (11.7) |
| 1967 | Alert Bay | 2,128 | 230 (10.7) | 195 (9.2) | 425 (19.9) |
| | Deepwater Bay | 3,000 | 554 (18.5) | 394 (13.1) | 948 (31.6) |
| | Qualicum | 4,082 | 1,505 (36.9) | 25 (0.6) | 1,530 (37.4) |
| 1968 | Alert Bay | 2,307 | 214 (9.3) | 228 (9.9) | 442 (19.2) |
| | Kingcome-Knight | 296 | 2 (0.7) | 184 (62.2) | 186 (62.9) |
| 1969 | Alert Bay | 4,245 | 397 (9.4) | 743 (17.5) | 1,140 (26.9) |
| | Deepwater Bay | 5,175 | 854 (16.5) | 317 (6.1) | 1,171 (22.6) |
| | Qualicum | 4,682 | 1,706 (36.4) | 37 (0.8) | 1,743 (37.2) |
| | Cowichan | 400 | 22 (5.5) | 3 (0.8) | 25 (37.2) |
| 1970 | Alert Bay | 13,393 | 1,530 (11.4) | 3,467 (25.9) | 4,997 (37.3) |
| | Kingcome-Knight | 134 | 6 (4.5) | 25 (18.7) | 31 (23.2) |
| | Texada Island | 1,824 | 338 (18.5) | 499 (27.4) | 837 (45.9) |
| Totals | | 48,375 | 7,980 (16.5) | 6,691 (13.8) | 14,671 (30.3) |

Table 2. Summaries of weekly percent of spawning ground and marine recoveries for tags applied in upper Johnstone Strait during years 1965 to 1970.

| Recovery area | Year | Tag week ending: To Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | From Nov. 11 | All weeks |
|---|---|---|---|---|---|---|---|---|---|---|
| Spawning ground | 1970 | - | 8.31 | 16.87 | 10.49 | 10.08 | 10.72 | 12.03 | 9.11 | 11.42 |
| Marine | | - | 25.88 | 13.86 | 32.51 | 33.75 | 36.95 | 28.11 | 4.95 | 25.89 |
| Total | | - | 34.19 | 30.73 | 43.00 | 43.83 | 47.67 | 40.14 | 14.06 | 37.31 |
| Spawning ground | 1969 | 5.34 | 6.13 | 13.84 | 11.67 | 5.85 | 9.13 | 9.36 | 7.09 | 9.35 |
| Marine | | 15.08 | 22.99 | 2.82 | 9.67 | 32.59 | 25.75 | 25.11 | 4.26 | 17.50 |
| Total | | 20.42 | 29.12 | 26.66 | 21.34 | 38.44 | 34.88 | 34.47 | 11.35 | 26.85 |
| Spawning ground | 1968 | - | 8.31 | 7.31 | 12.53 | 8.00 | 6.61 | 4.76 | 8.56 | 9.28 |
| Marine | | - | 4.98 | 3.32 | 5.04 | 20.73 | 18.25 | 28.57 | 12.56 | 9.88 |
| Total | | - | 13.29 | 10.63 | 17.57 | 28.73 | 24.86 | 33.33 | 21.12 | 19.16 |
| Spawning ground | 1967 | - | 4.85 | 9.55 | 12.28 | 11.09 | 15.43 | 13.70 | 0.0 | 10.71 |
| Marine | | - | 9.71 | 3.18 | 2.34 | 16.43 | 16.00 | 11.56 | 0.0 | 9.16 |
| Total | | - | 14.56 | 12.73 | 14.62 | 27.52 | 31.43 | 25.26 | 0.0 | 19.87 |
| Spawning ground | 1966 | 7.97 | 6.38 | 3.15 | 5.93 | 10.24 | 10.47 | 12.02 | 11.95 | 8.99 |
| Marine | | 9.81 | 4.79 | 0.0 | 0.79 | 2.41 | 2.71 | 1.17 | 1.63 | 2.68 |
| Total | | 17.78 | 11.17 | 3.15 | 6.72 | 1.65 | 13.18 | 13.19 | 13.58 | 11.67 |
| Spawning ground | 1965 | 6.35 | 7.02 | 8.57 | 6.47 | 5.32 | 11.36 | 13.33 | - | 9.17 |
| Marine | | 4.76 | 7.36 | 2.86 | 0.0 | 1.06 | 2.47 | 3.89 | - | 3.28 |
| Total | | 11.11 | 14.38 | 11.43 | 6.47 | 5.43 | 13.83 | 17.22 | - | 12.45 |
| Spawning ground | ALL | 5.47 | 7.16 | 13.93 | 10.69 | 8.86 | 10.28 | 12.00 | 8.94 | 10.53 |
| Marine | YEARS | 12.32 | 13.44 | 8.85 | 22.34 | 25.61 | 27.32 | 20.52 | 5.40 | 18.65 |
| Total | | 17.79 | 20.60 | 22.78 | 33.03 | 34.48 | 37.60 | 32.52 | 14.34 | 29.18 |

Table 3. Summaries of weekly percent of spawning ground and marine recoveries for tags applied in lower Johnstone Strait during 1962, 1967 and 1969.

| Recovery area | Year | Tag week ending To Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 24 | Nov. 4 | Nov. 11 | From Nov. 18 | All weeks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Spawning ground | 1969 | - | - | 16.74 | 16.80 | 16.63 | 11.81 | - | - | - | 16.50 |
| Marine | | - | - | 3.50 | 4.07 | 10.43 | 16.14 | - | - | - | 6.13 |
| Total | | - | - | 20.24 | 20.87 | 27.06 | 27.95 | - | - | - | 22.63 |
| Spawning ground | 1967 | - | - | - | - | - | - | 19.95 | 17.34 | - | 18.47 |
| Marine | | - | - | - | - | - | - | 14.62 | 12.01 | - | 13.13 |
| Total | | - | - | - | - | - | - | 34.57 | 29.35 | - | 31.60 |
| Spawning ground | 1962 | 3.66 | 6.15 | 10.04 | 4.95 | 5.44 | 14.89 | 15.75 | 20.29 | 15.66 | 9.43 |
| Marine | | 17.68 | 18.46 | 6.09 | 11.66 | 19.90 | 6.38 | 10.55 | 14.01 | 8.43 | 13.97 |
| Total | | 21.34 | 24.51 | 16.13 | 16.61 | 25.34 | 21.27 | 26.30 | 34.30 | 24.09 | 23.40 |
| Spawning ground | ALL | 3.66 | 6.15 | 14.27 | 14.76 | 12.28 | 12.90 | 18.45 | 17.65 | 15.66 | 14.92 |
| Marine | YEARS | 17.68 | 18.46 | 3.59 | 5.29 | 14.10 | 12.65 | 13.17 | 12.22 | 8.43 | 10.25 |
| Total | | 21.34 | 24.51 | 18.86 | 20.00 | 26.38 | 25.55 | 31.62 | 29.89 | 24.09 | 25.17 |

Table 4. Relative abundance and tag intensity for upper Johnstone Strait during 1965 to 1970.

| Tag week ending | Relative abundance index | Tags applied | Tags per unit of abundance | Relative abundance index | Tags applied | Tags per unit of abundance |
|---|---|---|---|---|---|---|
| | | 1970 | | | 1969 | |
| Aug. 26 | 18.6 | 22 | 1.21 | - | 0 | - |
| Sept. 2 | 30.5 | 14 | 0.46 | - | 0 | - |
| 9 | 81.6 | 77 | 0.94 | - | 0 | - |
| 16 | 95.8 | 0 | - | 73.0 | 0 | - |
| 23 | 182.1 | 0 | - | 119.0[a] | 431 | 3.62 |
| 30 | 191.4 | 313 | 1.64 | 164.9 | 261 | 1.58 |
| Oct. 7 | 214.3[a] | 2,128 | 9.93 | 193.3[a] | 708 | 3.66 |
| 14 | 237.2 | 3,688 | 15.55 | 221.8[a] | 900 | 4.06 |
| 21 | 324.0 | 1,508 | 4.65 | 250.2 | 632 | 2.53 |
| 28 | 319.0 | 2,406 | 7.54 | 368.3 | 734 | 1.99 |
| Nov. 4 | 202.0 | 1,430 | 7.07 | 154.1 | 438 | 2.84 |
| 11 | 127.9[a] | 1,920 | 15.01 | 64.5[a] | 141 | 2.18 |
| | | 1968 | | | 1967 | |
| Sept. 9 | 46.8[a] | 12 | 0.26 | | | |
| 16 | 93.5 | 0 | - | 8.0 | 0 | - |
| 23 | 237.7[a] | 0 | - | 18.2 | 0 | - |
| 30 | 381.8 | 301 | 0.78 | 111.0[a] | 103 | 0.93 |
| Oct. 7 | 392.1 | 301 | 0.77 | 203.8[a] | 597 | 2.93 |
| 14 | 443.0[a] | 774 | 1.75 | 296.5[a] | 171 | 0.58 |
| 21 | 493.8 | 275 | 0.56 | 389.3 | 487 | 1.25 |
| 28 | 564.8 | 378 | 0.67 | 236.7 | 175 | 0.74 |
| Nov. 4 | 342.8 | 21 | 0.06 | 143.9[a] | 467 | 3.24 |
| 11 | 208.0[a] | 257 | 1.24 | 87.5[a] | 116 | 1.33 |

[a]Extrapolated values.

Table 5. Exploitation and percent of tags recovered from chum salmon tagged in upper Johnstone Strait.

| Tagging year | Percent recovered tags in fisheries | Commercial catch total return | Tag period initiation | Catch adjustment[c] | Exploitation rate adjusted |
|---|---|---|---|---|---|
| 1950 | 35.6[a] | 2,765,000 / 4,177,900 | Aug. 21 | 44,966 | 65.1 |
| 1953 | 43.7[b] | 2,401,000 / 3,369,400 | Aug. 10 | 25,885 | 70.5 |
| 1965 | 3.3 | 3,5775 / 436,400 | Sept. 22 | 22,347 | 3.1 |
| 1966 | 2.7 | 60,850 / 1,026,200 | Sept. 16 | 45,516 | 1.5 |
| 1967 | 9.2 | 19,500 / 864,300 | Sept. 26 | 44,386 | 17.4 |
| 1968 | 9.9 | 863,200 / 2,714,300 | Sept. 22 | 150,113 | 26.3 |
| 1969 | 17.5 | 608,400 / 1,689,700 | Sept. 22 | 50,615 | 33.0 |
| 1970 | 25.9 | 1,025,225 / 2,203,800 | Sept. 24 | 132,812 | 40.5 |

[a]From Chatwin (1953).
[b]From Manzer (1953).
[c]Cumulated catch in areas 12 and 13 up to and including the week before tag period initiation.

Table 6. Percentage distribution of recovered tags applied during 1962 and 1965 to 1970.

| Recovery area | Tagging areas | | | | | |
|---|---|---|---|---|---|---|
| | Bond/Knight Inlet | Upper Johnstone Strait | Lower Johnstone Strait | Texada Island | Qualicum/ Baynes Sound | Cowichan |
| **Spawning Ground and Single Stock Fisheries** | | | | | | |
| Bond/Knight Inlet | 98.6 | 0.2 | | | | |
| Upper Johnstone Strait | | 0.3 | | | | |
| Lower Johnstone Strait | | 0.3 | 1.5 | 0.1 | | |
| Loughborough/Bute Inlet | | 0.8 | | | | |
| Mid-Vancouver Island | | 17.0 | 27.5 | 27.1 | 99.7 | |
| Toba Inlet | | 1.0 | 0.1 | 14.8 | | |
| Jervis Inlet | | 3.2 | 5.7 | 4.9 | | |
| Lower Vancouver Island | | 5.1 | 3.8 | 3.3 | 0.1 | |
| Southern Vancouver Island | | 0.8 | 3.5 | 0.7 | 0.1 | 100.0 |
| Howe Sound | | 1.9 | 4.6 | 1.9 | | |
| Fraser River | | 21.1 | 36.4 | 23.7 | 0.1 | |
| Washington State | | 0.3 | 2.3 | 1.0 | | |
| Sub-total | 98.6 | 52.0 | 85.4 | 77.5 | 100.0 | 100.0 |
| **Mixed Stock Fisheries** | | | | | | |
| Upper Vancouver Island | | 0.1 | 0.1 | | | |
| Upper Johnstone Strait | 1.4 | 21.4 | 1.1 | 1.0 | | |
| Lower Johnstone Strait | | 23.3 | 7.7 | 2.5 | | |
| Texada Island | | 3.2 | 5.7 | 19.0 | | |
| Sub-total | 1.4 | 48.0 | 14.6 | 22.5 | 0.0 | 0.0 |
| Total recovered | 215 | 7,392 | 2,916 | 839 | 3,273 | 25 |
| Tags applied | 430 | 25,367 | 11,590 | 1,824 | 8,764 | 400 |

Table 7. Mean lapsed times in days from tagging at upper Johnstone Strait to spawning ground dead recovery.

| Tag week ending | Mean | | | | All years | | |
|---|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | Mean | Tags recovered | Standard error |
| Sept. 30 | 39.4 | 47.8 | 41.3 | 49.8 | 46.9 | 57 | 1.55 |
| Oct. 7 | 45.7 | 48.4 | 44.0 | 46.5 | 46.0 | 478 | 0.49 |
| Oct. 14 | 50.0 | 47.6 | 43.8 | 46.0 | 46.0 | 548 | 0.52 |
| Oct. 21 | 46.7 | 44.7 | 41.7 | 48.5 | 46.8 | 233 | 0.80 |
| Oct. 28 | 50.3 | 50.1 | 44.2 | 52.1 | 50.5 | 328 | 0.60 |
| Nov. 4 | 45.5 | - | 45.4 | 47.6 | 46.8 | 250 | 0.78 |
| All weeks | 46.6 | 47.6 | 43.8 | 47.9 | 47.1 | | |
| Tags recovered | 200 | 171 | 310 | 1,213 | | 1,994 | |
| Standard error | 0.77 | 0.86 | 0.61 | 0.34 | | | 0.27 |

Table 8. Mean lapsed times in days from tagging at lower Johnstone Strait to spawning ground dead recovery.

| Tag week ending | Mean | | | All years | | |
|---|---|---|---|---|---|---|
| | 1962 | 1967 | 1969 | Mean | Tags recovered | Standard error |
| Oct. 7 | 38.3 | - | 42.5 | 41.7 | 158 | 0.89 |
| Oct. 14 | 45.7 | - | 41.0 | 41.3 | 418 | 0.58 |
| Oct. 21 | 45.5 | - | 40.3 | 41.3 | 228 | 0.79 |
| Oct. 28 | 46.1 | - | 40.0 | 42.8 | 45 | 2.02 |
| Nov. 4 | 47.5 | 43.7 | - | 44.9 | 340 | 0.67 |
| Nov. 11 | 43.0 | 43.5 | - | 43.4 | 311 | 0.50 |
| All weeks | 45.2 | 43.6 | 41.1 | 42.7 | | |
| Tags recovered | 262 | 507 | 731 | | 1,500 | |
| Standard error | 0.87 | 0.50 | 0.42 | | | 0.31 |

Table 9. Mean lapsed time in days from tagging at Texada Island to spawning ground dead recovery.

| Tag week ending | Year 1970 | Tags recovered | Standard error |
|---|---|---|---|
| Oct. 28 | 37.4 | 22 | 3.35 |
| Nov. 4 | 41.7 | 153 | 1.02 |
| Nov. 11 | 41.8 | 129 | 0.96 |
| All weeks | 41.4 | | |
| Tags recovered | | 304 | |
| Standard error | | | 0.70 |

Table 10. Mean lapsed time in days between tag sites, all stocks.

| Mean lapsed time and its standard error from tagging to spawning ground dead recovery from: | | | Difference in mean lapsed times and its standard error: | |
|---|---|---|---|---|
| Upper Johnstone Strait | Lower Johnstone Strait | Texada Island | Upper to lower Johnstone Strait | Upper Johnstone Strait to Texada Island |
| ∞47.1 ± 0.27<br>Ψ49.8 ± 0.52 | Φ42.7 ± 0.31 | ≈1.4 ± 0.70 | 4.4 ± 0.41 | 8.4 ± 0.87 |

∞ Tag week ending September 30 to November 4 for years 1967 to 1970.
Ψ Tag week ending October 7 to November 11 for years 1962, 1967 and 1969.
Φ Tag week ending October 21 to November 4 for year 1970.
≈ Tag week ending October 28 to November 11 for year 1970.

Table 11. Median lapsed time in days between succeeding marine recovery areas, all stocks.

| From: | To: | Median lapsed days from tagging at: Upper Johnstone Strait | Lower Johnstone Strait | Texada Island |
|---|---|---|---|---|
| Upper Johnstone Strait | Lower Johnstone Strait | 5 | - | - |
| | North/central St. Georgia | 14 | - | - |
| | Southern St. of Georgia | 23 | - | - |
| | Washington State | 17 | - | - |
| Lower Johnstone Strait | North/central St. Georgia | 9 | 10 | - |
| | Southern St. of Georgia | 18 | 16 | - |
| | Washington State | 12 | 16 | - |
| Texada Island | Southern St. of Georgia | 9 | 6 | 8 |
| | Washington State | 3 | 6 | 8 |

Table 12. Mean lapsed time and duration of marine recovery.

| To marine recovery at statistical area | From tagging at Upper Johnstone Strait: Mean lapsed time | Days between the 5 to 95 (%) | Days between the 25 to 75 (%) | Lower Johnstone Strait: Mean lapsed time | Days between the 5 to 95 (%) | Days between the 25 to 75 (%) | Texada Island: Mean lapsed time | Days between the 5 to 95 (%) | Days between the 25 to 75 (%) |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 5.7 | 14.4 | 7.2 | | | | | | |
| 13 | 7.7 | 17.4 | 8.0 | 4.6 | 12.5 | 6.4 | | | |
| 12 and 13 | 6.8 | 16.2 | 7.7 | | | | | | |
| 14 | 19.0 | 34.8 | 14.2 | 13.2 | 27.7 | 11.0 | 5.6 | 16.8 | 9.2 |
| 15 | 11.9 | 26.3 | 11.8 | - | - | - | 3.8 | 8.9 | 4.2 |
| 16 | 16.1 | 29.8 | 12.2 | 11.4 | 26.6 | 12.4 | 4.9 | 11.3 | 5.2 |
| 14, 15 and 16 | 15.6 | 30.9 | 12.6 | 12.0 | 27.1 | 12.4 | 4.4 | 11.3 | 5.6 |
| 17 | 15.4 | 28.0 | 11.5 | - | - | - | 3.9 | 8.5 | 3.8 |
| 18 | 23.9 | 27.2 | 11.2 | 15.3 | 31.4 | 13.2 | - | - | - |
| 29 | 23.6 | 30.4 | 12.1 | 16.0 | 18.2 | 7.5 | 18.2 | 18.0 | 7.4 |
| 17, 18 and 29 | 22.8 | 31.0 | 12.6 | 16.1 | 32.4 | 13.4 | 16.1 | 23.6 | 9.7 |
| Washington State | 18.2 | 27.0 | 11.0 | 17.1 | 24.8 | 12.2 | 7.1 | 10.8 | 4.4 |

Table 13. Mean lapsed days between upper and lower Johnstone Strait tag sites for individual stocks and populations.

| Stock/population | Mean lapsed times standard error from: upper Johnstone Strait | Lower Johnstone Strait | Differences in mean lapsed time and standard error | Number of tags |
|---|---|---|---|---|
| Middle Vancouver Island | 48.5 ± 0.32 | 43.2 ± 0.41 | 5.3 ± 0.52 | 1,729 |
| Puntledge | 44.1 ± 1.07 | 42.8 ± 1.25 | 1.3 ± 1.65 | 194 |
| Big Qualicum | 49.5 ± 0.45 | 40.4 ± 0.53 | 9.1 ± 0.70 | 615 |
| Little Qualicum | 48.3 ± 0.48 | 43.2 ± 0.68 | 5.1 ± 0.84 | 751 |
| Jervis Inlet | 40.6 ± 0.65 | 40.3 ± 0.91 | 0.3 ± 1.12 | 327 |
| Saltery Bay | 39.2 ± 0.70 | 37.4 ± 0.88 | 1.8 ± 1.12 | 243 |
| Lower Vancouver Island | 42.6 ± 0.82 | 34.5 ± 0.80 | 8.1 ± 1.15 | 221 |
| Nanaimo | 43.9 ± 1.25 | 33.2 ± 1.06 | 10.7 ± 1.63 | 82 |
| Southern Vancouver Island | 51.2 ± 2.36 | 49.4 ± 2.00 | 1.8 ± 3.10 | 78 |
| Howe Sound | 53.5 ± 1.24 | 49.9 ± 1.03 | 3.6 ± 1.61 | 218 |
| Squamish | 52.8 ± 1.96 | 52.9 ± 1.99 | 0.0 ± 2.80 | 61 |
| Cheakamus | 55.9 ± 2.14 | 47.9 ± 1.00 | 8.0 ± 2.36 | 108 |
| Fraser River | 47.4 ± 0.49 | 43.0 ± 0.43 | 4.4 ± 0.66 | 876 |
| Stave | 40.2 ± 0.97 | 37.8 ± 1.04 | 2.4 ± 1.42 | 119 |
| Harrison | 50.5 ± 0.67 | 46.0 ± 0.69 | 4.5 ± 0.96 | 358 |
| Chehalis | 43.8 ± 1.61 | 42.3 ± 1.33 | 1.5 ± 2.08 | 105 |
| Squakum | 44.2 ± 1.29 | 40.0 ± 1.51 | 4.2 ± 1.99 | 82 |
| Vedder | 51.8 ± 1.49 | 45.1 ± 1.33 | 6.7 ± 2.00 | 131 |
| All stocks | 47.1 ± 0.27 | 42.7 ± 0.31 | 4.4 ± 0.41 | 2,394 |

Table 14. Significantly different mean lapsed days between upper and lower Johnstone Strait tag sites.

| Stock/population | Mean lapsed days[a] |
|---|---|
| Jervis Inlet | 0.3 |
| Southern Vancouver Island | 1.8 |
| Howe Sound | 3.6 |
| Fraser River | 4.4 |
| Middle Vancouver Island | 5.3 |
| Lower Vancouver Island | 8.1 |
| Squamish | 0.0 |
| Puntledge | 1.3 |
| Chehalis | 1.5 |
| Saltery Bay | 1.8 |
| Stave | 2.4 |
| Squakum | 4.2 |
| Harrison | 4.5 |
| Little Qualicum | 5.1 |
| Vedder | 6.7 |
| Cheakamus | 8.0 |
| Big Qualicum | 9.1 |
| Nanaimo | 10.7 |

[a]Adjacent means joined by brackets are not significantly different at $p>0.20$.

Table 15. Significantly different mean lapsed days from lower Johnstone Strait tag site to spawning ground dead recovery.

| Stock/population | Mean lapsed days[a] |
|---|---|
| Lower Vancouver Island | 34.5 |
| Jervis Inlet | 40.3 |
| Fraser River | 43.0 |
| Middle Vancouver Island | 43.2 |
| Southern Vancouver Island | 49.4 |
| Howe Sound | 49.9 |
| Nanaimo | 33.2 |
| Saltery | 37.4 |
| Stave | 37.8 |
| Squakum | 40.0 |
| Big Qualicum | 40.4 |
| Chehalis | 42.3 |
| Puntledge | 42.8 |
| Little Qualicum | 43.2 |
| Vedder | 45.1 |
| Harrison | 46.0 |
| Cheakamus | 47.9 |
| Squamish | 52.9 |

[a]Adjacent means joined by brackets are not significantly different at $p>0.20$.

Table 16. Mean lapsed days to Cottonwood test-fishing recovery for tags applied at upper and lower Johnstone Strait; before and after October 14.

| Tagged to October 14 | | | Tagged from October 15 | | | Seasonal | | | Period difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| Number recovered | Mean | Standard error | Number recovered | Mean | Standard error | Total recovered | Mean | Standard error | Mean | Standard error |
| | | | | Upper Johnstone Strait | | | | | | |
| 26 | 21.3 | ±1.11 | 35 | 25.5 | ±1.07 | 61 | 23.7 | ±0.81 | 4.2 | ±1.54 |
| | | | | Lower Johnstone Strait | | | | | | |
| 14 | 16.7 | ±1.37 | 21 | 22.6 | ±1.41 | 35 | 20.2 | ±1.11 | 5.9 | ±1.72 |
| | | | | Tag site difference | | | | | | |
| 40 | 4.6 | ±1.76 | 56 | 2.9 | ±1.77 | 96 | 3.5 | ±1.37 | | |

Table 17. Mean lapsed days of Fraser River spawning ground dead recoveries for tags applied at upper and lower Johnstone Strait; before and after October 14.

| Populations/ stock | Tagged to October 14 | | | Tagged from October 15 | | | Seasonal | | | Period difference | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number recovered | Mean | Standard error | Number recovered | Mean | Standard error | Total recovered | Mean | Standard error | Mean | Standard error |
| **Upper Johnstone Strait** | | | | | | | | | | | |
| Fraser River | 275 | 45.5 | ±0.63 | 171 | 50.5 | ±0.75 | 446 | 47.4 | ±0.49 | 5.0 | ±0.97 |
| Stave | 59 | 40.7 | ±0.95 | 6 | 35.2 | ±3.62 | 65 | 40.2 | ±0.95 | -5.5 | ±3.75 |
| Harrison | 71 | 48.4 | ±0.98 | 115 | 51.9 | ±0.62 | 186 | 50.5 | ±0.67 | 3.5 | ±1.16 |
| Chehalis | 36 | 43.0 | ±1.49 | 12 | 46.3 | ±3.38 | 48 | 43.8 | ±1.61 | 3.3 | ±3.41 |
| Squakum | 42 | 44.2 | ±1.26 | 5 | 43.8 | ±2.37 | 47 | 44.2 | ±1.28 | -0.4 | ±2.69 |
| Vedder | 46 | 50.7 | ±1.99 | 25 | 53.6 | ±1.75 | 71 | 51.8 | ±1.48 | 2.9 | ±2.66 |
| **Lower Johnstone Strait** | | | | | | | | | | | |
| Fraser River | 218 | 40.1 | ±0.56 | 212 | 45.8 | ±0.65 | 430 | 43.0 | ±0.43 | 5.7 | ±0.86 |
| Stave | 44 | 38.3 | ±1.11 | 10 | 35.3 | ±2.70 | 54 | 37.8 | ±1.04 | -3.0 | ±2.91 |
| Harrison | 43 | 40.2 | ±1.11 | 129 | 47.8 | ±0.74 | 172 | 46.0 | ±0.68 | 7.6 | ±1.33 |
| Chehalis | 42 | 39.7 | ±1.22 | 15 | 49.5 | ±2.07 | 57 | 42.3 | ±1.33 | 9.8 | ±2.41 |
| Squakum | 27 | 41.2 | ±1.54 | 8 | 36.4 | ±2.83 | 35 | 40.0 | ±1.51 | -4.8 | ±3.22 |
| Vedder | 28 | 43.5 | ±1.99 | 32 | 45.2 | ±1.67 | 60 | 45.1 | ±1.33 | 1.7 | ±2.60 |
| **Tag site difference** | | | | | | | | | | | |
| Fraser River | 493 | 5.4 | ±0.84 | 383 | 4.7 | ±0.99 | 876 | 4.4 | ±0.66 | | |
| Stave | 103 | 2.4 | ±1.17 | 16 | - | - | 119 | 2.4 | ±1.42 | | |
| Harrison | 114 | 8.2 | ±1.48 | 244 | 4.1 | ±0.97 | 358 | 4.5 | ±0.96 | | |
| Chehalis | 78 | 3.3 | ±1.93 | 27 | - | - | 105 | 1.5 | ±2.08 | | |
| Squakum | 69 | 3.0 | ±1.99 | 13 | 7.4 | ±3.69 | 82 | 4.2 | ±1.99 | | |
| Vedder | 74 | 7.2 | ±2.81 | 57 | 8.4 | ±2.43 | 131 | 6.7 | ±2.00 | | |

Table 18. Mean lapsed days from tagging at Texada Island to spawning ground dead recovery for mid-Vancouver Island stock.

| Stock/population | Tags recovered | Mean | Standard error |
|---|---|---|---|
| Mid-Vancouver Island | 197 | 40.3 | ±0.75 |
| Big Qualicum | 98 | 44.0 | ±0.80 |
| Little Qualicum | 90 | 35.6 | ±1.12 |

Table 19. Weekly mean lapsed days from tagging at Qualicum-Baynes Sound to spawning ground dead recovery.

| Tag week ending | 1967 days | 1969 days | All years Days | All years Tags | Standard error |
|---|---|---|---|---|---|
| Oct. 21 | 42.9 | - | 42.9 | 239 | ±0.93 |
| Oct. 28 | 45.4 | 34.4 | 41.7 | 198 | ±1.35 |
| Nov. 4 | 42.2 | 30.9 | 36.3 | 291 | ±0.82 |
| Nov. 11 | 35.2 | 35.4 | 35.3 | 161 | ±1.06 |
| Nov. 11 | 25.6 | 30.9 | 27.4 | 429 | ±0.43 |
| Nov. 25 | 22.6 | 23.6 | 23.2 | 753 | ±0.32 |
| Dec. 2 | 23.1 | 21.1 | 21.5 | 760 | ±0.28 |
| All weeks | 31.5 | 24.9 | 28.1 | | |
| Tags recovered | 1,395 | 1,436 | | 2,831 | |
| Standard error | ±0.41 | ±0.27 | | | ±0.25 |

Table 20. Mean lapsed days from tagging at Big Qualicum River estuary to passage through the fence and spawning ground dead recovery∞ in 1961.

| Tag week ending | Tags applied | Fence | | Spawning ground | | |
|---|---|---|---|---|---|---|
| | | Tags observed | Lapsed days | Tags recovered | Lapsed days | Life span |
| Nov. 11 | 213 | 120 | 15.9 | 57 | 29.9 | 14.0 |
| Nov. 18 | 250 | 183 | 10.6 | 63 | 25.2 | 14.6 |
| Nov. 25 | 291 | 233 | 7.6 | 96 | 21.3 | 13.7 |
| Dec. 2 | 305 | 173 | 5.3 | 70 | 17.8 | 12.5 |
| All weeks | 1,059 | 709 | 9.2 | 296 | 23.0 | 13.8 |

∞Adapted from Walker and Lister 1965.

Table 21. Seasonal mean lapsed days from tagging at Qualicum-Baynes Sound to spawning ground dead recovery for years 1967 and 1969.

| Stock/population | Tags recovered | Lapsed days to spawning ground dead recovery | |
|---|---|---|---|
| | | Mean | Standard error |
| Mid-Vancouver Island | 2,831 | 28.1 | ±0.25 |
| Puntledge | 164 | 31.5 | ±1.03 |
| Big Qualicum | 1,728 | 23.6 | ±0.21 |
| Little Qualicum | 538 | 31.2 | ±0.63 |

Tale 22. Lapsed days between tag sites and spawning grounds for the mid-Vancouver Island sub-area stock and its population.

| Stock/populations | Lapsed days from | | | | | |
|---|---|---|---|---|---|---|
| | Upper Johnstone Strait to spawning ground dead recovery | Upper to lower Johnstone Strait | Lower Johnstone Strait to Texada Island[a] | Texada Island to Qualicum-Baynes Sound | Lower Johnstone Strait to Qualicum-Baynes Sound | Baynes Sound[c] |
| Mid-Vancouver Island | 48.8 | 5.3 ± 0.52 | 2.9 ± 0.85 | 12.2 ± 0.78 | 15.1 ± 0.49 | 15.4 |
| Puntledge | 44.1 | 1.3 ± 1.65 | -[b] | - | 11.3 ± 1.62 | 18.8 |
| Big Qualicum | 49.5 | 9.1 ± 0.70 | - | - | 16.8 ± 0.57 | 10.9 |
| Little Qualicum | 48.4 | 5.1 ± 0.84 | 7.6 ± 13.1 | 4.4 ± 1.29 | 12.1 ± 0.93 | 18.5 |

[a]Tagging data from Texada Island is not representative of total season.
[b]No tags recovered in Puntledge River from Texada Island tag site.
[c]Spawning ground lifespan estimated at 12.7 days.

Table 23. Duration of delay in days of mid-Vancouver Island sub-area populations in the "open gulf" and Qualicum-Baynes Sound (sample size in brackets).

| Lapsed days from tagging at lower Johnstone Strait to spawning ground dead recovery | | | | | Lapsed days from tagging at Qualicum-Baynes Sound to spawning ground dead recovery | | | | | Duration of delay in "open gulf" of Strait of Georgia | | | | Durations of delay in Qualicum-Baynes Sound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tag week ending | Stock | Puntledge | Big Qualicum | Little Qualicum | Tab week ending | Stock | Puntledge | Big Qualicum | Little Qualicum | Stock | Puntledge | Big Qualicum | Little Qualicum | Stock | Puntledge | Big Qualicum | Little Qualicum |
| To Oct. 7 | 47.8 (46) | 57.0 (6) | | 46.7 (31) | Oct. 21 | 42.9 (239) | 39.0 (3) | 40.2 (22) | 41.0 (195) | 3.8 | 8.2 | | | 28.9 | 23.3 | | |
| Oct. 14 | 45.5 (128) | 43.6 (28) | 45.8 (15) | 46.1 (74) | Oct. 28 | 41.7 (198) | 37.6 (25) | 35.8 (35) | 34.4 (46) | | | 9.5 | 6.5 | | | 22.2 | 25.2 |
| Oct. 21 | 43.4 (113) | 40.1 (25) | 46.2 (19) | 43.5 (63) | Nov. 4 | 36.3 (291) | 30.3 (56) | 36.2 (103) | 28.6 (72) | | 9.7 | | | | 16.6 | | |
| Oct. 28 | 37.2 (23) | 37.0 (3) | 37.9 (9) | 34.4 (11) | Nov. 11 | 35.3 (161) | 29.9 (74) | 30.8 (6) | - | 11.2 | | 15.6 | 13.9 | 18.3 | | 11.3 | 14.7 |
| Nov. 4 | 42.5 (191) | 42.9 (16) | 40.6 (100) | 41.3 (46) | Nov. 18 | 27.4 (429) | 30.7 (3) | 24.7 (324) | 27.4 (25) | | 9.5 | | | | 21.2 | | |
| Nov. 11 | 41.1 (166) | 43.5 (12) | 38.3 (86) | 39.3 (38) | Nov. 25 | 23.2 (753) | 36.7 (3) | 22.6 (629) | 22.6 (89) | 18.3 | | 16.4 | 18.2 | 9.8 | | 9.2 | 9.7 |
| Nov. 18 | 31.4 (8) | - | 33.6 (5) | - | Dec. 2 | 21.5 (760) | - | 20.7 (609) | 21.8 (111) | | | | | | | | |
| All weeks | 43.2 (675) | 42.8 (90) | 40.4 (237) | 43.2 (264) | All weeks | 28.1 (2831) | 31.5 (164) | 23.6 (1728) | 31.2 (538) | 15.1 | 11.3 | 16.8 | 12.1 | 14.3 | 17.7 | 9.8 | 17.4 |

*Spawning ground lifespan estimated at 14.5, 13.5, 12.5 days, respectively, for early, middle and late segments.

Table 24. Percent entry between, and percent composition among, weeks for sub-area stocks into upper Johnstone Strait.

| Sub-area stock | Percent entry and percent composition for week ending | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Early | | | Middle | | | Late | | | | |
| | To Sept. 16 | Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | Nov. 11 | From Nov. 18 | All weeks |
| Upper Johnstone Strait | | | | | | | 6.3 | 6.3 | 58.3 | 29.1 | 100.0 |
| | | | | | | | 0.7 | 1.1 | 17.8 | 25.8 | 1.8 |
| Lower Johnstone Strait | | 15.4 | 35.1 | 30.1 | 19.4 | | | | | | 100.0 |
| | | 3.0 | 2.5 | 1.8 | 1.0 | | | | | | 0.8 |
| Loughborough to Bute Inlet | | | 30.9 | 32.8 | 22.7 | 13.6 | | | | | 100.0 |
| | | | 13.7 | 12.1 | 7.1 | 3.4 | | | | | 4.8 |
| Mid-Vancouver Island | | 0.4 | 2.4 | 8.0 | 15.0 | 26.1 | 29.0 | 13.4 | 4.4 | 1.3 | 100.0 |
| | | 1.8 | 4.1 | 11.2 | 17.7 | 24.4 | 28.9 | 23.3 | 13.4 | 11.9 | 18.1 |
| Toba Inlet | | | 15.4 | 29.7 | 12.7 | 28.1 | 14.1 | | | | 100.0 |
| | | | 3.7 | 6.0 | 2.2 | 3.8 | 2.0 | | | | 2.6 |
| Jervis Inlet | | 1.3 | 3.7 | 14.6 | 21.3 | 26.9 | 15.6 | 14.4 | 2.2 | | 100.0 |
| | | 1.7 | 1.8 | 6.0 | 7.4 | 7.4 | 4.5 | 7.3 | 2.0 | | 5.3 |
| Lower Vancouver Island | 14.2 | 15.4 | 20.1 | 18.0 | 14.1 | 9.3 | 7.5 | 1.4 | | | 100.0 |
| | 74.2 | 19.5 | 9.3 | 7.0 | 4.6 | 2.4 | 2.1 | 0.7 | | | 5.0 |
| Southern Vancouver Island | | | 5.5 | 7.3 | 15.3 | 27.8 | 25.8 | 12.5 | 5.8 | | 100.0 |
| | | | 4.4 | 4.9 | 8.8 | 12.6 | 12.5 | 10.6 | 8.7 | | 8.8 |
| Howe Sound & Burrard Inlet | | 0.6 | 6.8 | 15.3 | 21.8 | 20.3 | 22.3 | 9.4 | 3.5 | | 100.0 |
| | | 1.0 | 4.0 | 7.4 | 9.0 | 6.6 | 7.8 | 5.7 | 3.7 | | 6.4 |
| Fraser River | | 6.3 | 13.3 | 12.3 | 13.9 | 16.5 | 16.3 | 11.6 | 7.0 | 2.8 | 100.0 |
| | | 73.0 | 56.5 | 43.6 | 42.2 | 39.2 | 41.5 | 51.3 | 54.4 | 62.3 | 46.4 |
| All stocks | 0.7 | 4.0 | 10.9 | 13.0 | 15.4 | 19.4 | 18.2 | 10.4 | 5.9 | 2.1 | 100.0 |
| | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | |

Table 25. Weekly population percent composition in Statistical Area 12 for years 1965 to 1970.

| | Week ending | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Early | | | Middle | | | Late | | | | |
| | Sept. 16 | Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | Nov. 11 | Nov. 18 | Total |
| Mid Vancouver Is. | | | | | | | | | | | |
| Catch | | 1,616 | 9,277 | 19,866 | 52,903 | 130,427 | 132,821 | 24,490 | 0 | 0 | 371,400 |
| Escapement | | 4,400 | 26,800 | 99,000 | 169,200 | 255,900 | 297,000 | 174,100 | 64,800 | 19,800 | 1,111,000 |
| Total | | 6,016 | 36,077 | 118,866 | 222,103 | 386,327 | 429,821 | 198,540 | 64,800 | 19,800 | 1,482,400 |
| Percent | | 0.4 | 2.4 | 8.0 | 15.0 | 26.1 | 29.0 | 13.4 | 4.4 | 1.3 | |
| Puntledge | | | | | | | | | | | |
| Catch | | 625 | 2,655 | 5,405 | 13,520 | 26,345 | 13,720 | 1,070 | 0 | | 63,340 |
| Escapement | | 1,700 | 7,670 | 26,950 | 43,260 | 51,700 | 30,690 | 7,620 | 3,410 | | 173,000 |
| Total | | 2,325 | 10,325 | 32,355 | 56,780 | 78,045 | 44,410 | 8,690 | 3,410 | | 236,340 |
| Percent | | 1.0 | 4.4 | 13.7 | 24.0 | 33.0 | 18.8 | 3.7 | 1.4 | | |
| Big Qualicum | | | | | | | | | | | |
| Catch | | | | 1,525 | 8,565 | 39,010 | 69,225 | 15,445 | 0 | 0 | 133,770 |
| Escapement | | | | 7,600 | 27,400 | 76,550 | 154,800 | 109,800 | 44,370 | 11,980 | 432,500 |
| Total | | | | 9,125 | 35,965 | 115,560 | 224,025 | 125,245 | 44,370 | 11,980 | 566,270 |
| Percent | | | | 1.6 | 6.4 | 20.4 | 39.6 | 22.1 | 7.8 | 2.1 | |
| Little Qualicum | | | | | | | | | | | |
| Catch | | 310 | 2,650 | 8,440 | 25,045 | 49,930 | 36,235 | 4,810 | 0 | | 127,380 |
| Escapement | | 850 | 7,650 | 42,070 | 80,100 | 97,980 | 81,050 | 34,200 | 11,100 | | 355,000 |
| Total | | 1,160 | 10,300 | 50,470 | 105,145 | 147,910 | 117,285 | 39,010 | 11,100 | | 482,380 |
| Percent | | 0.2 | 2.1 | 10.5 | 21.8 | 30.7 | 24.3 | 8.1 | 2.3 | | |
| Lower Vancouver Is. | | | | | | | | | | | |
| Catch | 25,042 | 17,699 | 20,881 | 7,267 | 14,424 | 17,772 | 19,268 | 0 | | | 122,353 |
| Escapement | 33,500 | 45,800 | 62,000 | 67,000 | 43,500 | 20,700 | 11,600 | 5,800 | | | 289,900 |
| Total | 58,542 | 63,499 | 82,881 | 74,267 | 57,924 | 38,472 | 30,868 | 5,800 | | | 412,253 |
| Percent | 14.2 | 15.4 | 20.1 | 18.0 | 14.1 | 9.3 | 7.5 | 1.4 | | | |

Table 25 (cont'd)

| | Week ending | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Early | | | Middle | | | Late | | | | |
| | Sept. 16 | Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | Nov. 11 | Nov. 18 | Total |
| Nanaimo | | | | | | | | | | | |
| Catch | 12,200 | 9,200 | 12,580 | 5,820 | 13,300 | 13,020 | 12,570 | | | | 78,690 |
| Escapement | 16,320 | 23,800 | 37,360 | 53,660 | 40,120 | 15,170 | 7,570 | | | | 194,000 |
| Total | 28,520 | 33,000 | 49,940 | 59,480 | 53,420 | 28,190 | 20,140 | | | | 272,690 |
| Percent | 10.5 | 12.1 | 18.3 | 21.8 | 19.6 | 10.3 | 7.4 | | | | |
| Southern Van. Is. | | | | | | | | | | | |
| Catch | | | 7,028 | 4,488 | 16,398 | 66,203 | 62,115 | 13,115 | 2,299 | | 171,646 |
| Escapement | | | 32,400 | 48,100 | 93,500 | 134,000 | 124,100 | 77,000 | 39,700 | | 548,800 |
| Total | | | 39,428 | 52,588 | 109,898 | 200,203 | 186,215 | 90,115 | 41,999 | | 720,446 |
| Percent | | | 5.5 | 7.3 | 15.3 | 27.8 | 25.8 | 12.5 | 5.8 | | |
| Cowichan | | | | | | | | | | | |
| Catch | | | | 850 | 7,770 | 50,230 | 61,860 | 13,060 | 2,290 | | 135,950 |
| Escapement | | | | 9,130 | 44,320 | 101,670 | 123,600 | 76,670 | 39,500 | | 395,000 |
| Total | | | | 9,980 | 52,090 | 151,900 | 185,460 | 89,730 | 41,790 | | 530,950 |
| Percent | | | | 1.9 | 9.8 | 28.6 | 34.9 | 16.9 | 7.9 | | |
| Jervis Inlet | | | | | | | | | | | |
| Catch | | 1,467 | 3,942 | 9,216 | 25,354 | 42,299 | 20,168 | 10,914 | 0 | | 113,360 |
| Escapement | | 4,000 | 12,000 | 54,100 | 67,000 | 74,800 | 47,400 | 51,500 | 9,600 | | 320,400 |
| Total | | 5,467 | 15,942 | 63,316 | 92,354 | 117,099 | 67,568 | 62,414 | 9,600 | | 433,760 |
| Percent | | 1.3 | 3.7 | 14.6 | 21.3 | 27.0 | 15.5 | 14.4 | 2.2 | | |
| Saltery Bay | | | | | | | | | | | |
| Catch | | | 840 | 1,600 | 5,330 | 8,500 | 4,830 | 2,950 | 0 | | 24,050 |
| Escapement | | | 2,560 | 9,390 | 14,080 | 15,040 | 11,350 | 13,910 | 2,670 | | 69,000 |
| Total | | | 3,300 | 10,990 | 19,410 | 23,540 | 16,180 | 16,860 | 2,670 | | 93,050 |
| Percent | | | 3.6 | 11.8 | 20.9 | 25.3 | 17.4 | 18.1 | 2.9 | | |

Table 25 (cont'd)

| | Week ending | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Early | | | Middle | | | Late | | | | |
| | Sept. 16 | Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | Nov. 11 | Nov. 18 | Total |
| Howe Sound | | | | | | | | | | | |
| Catch | | 850 | 9,008 | 15,560 | 34,616 | 44,342 | 35,154 | 7,304 | 26 | | 146,860 |
| Escapement | | 2,300 | 26,500 | 63,800 | 78,900 | 60,700 | 80,600 | 41,600 | 18,000 | | 372,400 |
| Total | | 3,150 | 35,508 | 79,360 | 113,516 | 105,042 | 115,754 | 48,904 | 18,026 | | 519,260 |
| Percent | | 0.6 | 6.8 | 15.3 | 21.8 | 20.3 | 22.3 | 9.4 | 3.5 | | |
| Squamish | | | | | | | | | | | |
| Catch | | | | 10,590 | 16,890 | 31,940 | 13,800 | 1,360 | | | 74,580 |
| Escapement | | | | 43,410 | 38,500 | 43,730 | 31,640 | 7,720 | | | 165,000 |
| Total | | | | 54,000 | 55,390 | 75,670 | 45,440 | 9,080 | | | 239,580 |
| Percent | | | | 22.5 | 23.1 | 31.6 | 19.0 | 3.8 | | | |
| Cheakamus | | | | | | | | | | | |
| Catch | | | 1,680 | 4,640 | 10,770 | 13,610 | 12,310 | 2,590 | 5 | | 45,405 |
| Escapement | | | 4,940 | 19,020 | 24,550 | 18,640 | 28,240 | 14,770 | 3,340 | | 113,500 |
| Total | | | 6,620 | 23,660 | 35,320 | 32,250 | 40,550 | 17,360 | 3,345 | | 159,105 |
| Percent | | | 4.2 | 14.9 | 22.2 | 20.3 | 25.5 | 10.9 | 2.0 | | |
| Fraser River | | | | | | | | | | | |
| Catch | | 91,264 | 192,625 | 93,728 | 136,008 | 310,837 | 330,805 | 187,787 | 55,957 | 19,006 | 1,418,017 |
| Escapement | | 146,500 | 309,100 | 371,500 | 394,800 | 311,800 | 285,800 | 250,600 | 207,400 | 85,100 | 2,362,600 |
| Total | | 237,764 | 501,725 | 465,228 | 530,800 | 622,637 | 616,605 | 438,387 | 263,357 | 104,106 | 3,780,617 |
| Percent | | 6.3 | 13.3 | 12.3 | 13.9 | 16.5 | 16.3 | 11.6 | 7.0 | 2.8 | |
| Stave | | | | | | | | | | | |
| Catch | | 28,300 | 48,540 | 31,770 | 35,540 | 49,920 | 23,690 | | | | 217,760 |
| Escapement | | 45,430 | 77,920 | 125,930 | 103,170 | 50,080 | 20,470 | | | | 423,000 |
| Total | | 73,730 | 126,460 | 157,700 | 138,710 | 100,000 | 44,160 | | | | 640,760 |
| Percent | | 11.5 | 19.8 | 24.6 | 21.6 | 15.6 | 6.9 | | | | |

Table 25 (cont'd)

| | Week ending | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Early | | | Middle | | | Late | | | | |
| | Sept. 16 | Sept. 23 | Sept. 30 | Oct. 7 | Oct. 14 | Oct. 21 | Oct. 28 | Nov. 4 | Nov. 11 | Nov. 18 | Total |
| Harrison | | | | | | | | | | | |
| Catch | | 17,500 | 33,440 | 16,700 | 26,880 | 69,500 | 139,600 | 85,910 | 36,150 | 14,060 | 439,740 |
| Escapement | | 28,100 | 53,690 | 66,180 | 78,040 | 69,740 | 120,630 | 114,660 | 133,990 | 62,970 | 728,000 |
| Total | | 45,600 | 87,130 | 82,880 | 104,920 | 139,240 | 260,230 | 200,570 | 170,140 | 77,030 | 1,167,740 |
| Squalcum | | | | | | | | | | | |
| Catch | | | 8,050 | 8,060 | 6,680 | 13,060 | 5,290 | 2,220 | | | 43,360 |
| Escapement | | | 12,940 | 31,970 | 19,420 | 13100 | 4,590 | 2,980 | | | 85,000 |
| Total | | | 20,990 | 40,030 | 26,100 | 26,160 | 9,880 | 5,200 | | | 128,360 |
| Percent | | | 16.4 | 31.2 | 20.3 | 20.4 | 7.7 | 4.0 | | | |
| Chehalis | | | | | | | | | | | |
| Catch | | 18,400 | 28,900 | 4,250 | 8,320 | 21,260 | 14,420 | 10,820 | 1,030 | | 107,400 |
| Escapement | | 29,540 | 46,380 | 16,830 | 24,180 | 21,330 | 12,470 | 14,450 | 3,820 | | 169,000 |
| Total | | 47,940 | 75,280 | 21,080 | 32,500 | 42,590 | 26,890 | 25,270 | 4,850 | | 276,400 |
| Percent | | 17.3 | 27.2 | 7.6 | 11.8 | 15.5 | 9.7 | 9.1 | 1.8 | | |
| Weaver | | | | | | | | | | | |
| Catch | | | 3,570 | 310 | 690 | 1,650 | 3,900 | 5,240 | 840 | | 16,200 |
| Escapement | | | 5,740 | 1,250 | 2,020 | 1,660 | 3,400 | 7,000 | 3,130 | | 24,200 |
| Total | | | 9,310 | 1,560 | 2,710 | 3,310 | 7,300 | 12,240 | 3,970 | | 40,400 |
| Percent | | | 23.0 | 3.9 | 6.7 | 8.2 | 18.1 | 30.3 | 9.8 | | |
| Vedder | | | | | | | | | | | |
| Catch | | 19,960 | 34,250 | 20,150 | 29,240 | 59,430 | 100,470 | 36,700 | 3,360 | | 303,560 |
| Escapement | | 32,040 | 54,980 | 79,900 | 84,910 | 59,620 | 86,800 | 48,990 | 12,460 | | 459,700 |
| Total | | 52,000 | 89,230 | 100,050 | 114,150 | 119,050 | 187,270 | 85,690 | 15,820 | | 763,260 |
| Percent | | 6.8 | 11.7 | 13.1 | 15.0 | 15.6 | 24.5 | 11.2 | 2.1 | | |

Table 26. Percent entry between, and percent composition among, by week for major populations into upper Johnstone Strait.

| Population | To Sept. 16 | Early Sept. 23 | Early Sept. 30 | Middle Oct. 7 | Middle Oct. 14 | Middle Oct. 21 | Late Oct. 28 | Late Nov. 4 | Late Nov. 11 | From Nov. 18 | All weeks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Puntledge | | 1.0 | 4.4 | 13.7 | 24.0 | 33.0 | 18.8 | 3.7 | 1.4 | | 100.0 |
| | | 38.6 | 28.6 | 27.2 | 25.6 | 20.2 | 10.3 | 4.4 | 5.3 | | 15.9 |
| Big Qualicum | | | | 1.6 | 6.4 | 20.4 | 39.6 | 22.1 | 7.8 | 2.1 | 100.0 |
| | | | | 7.7 | 16.2 | 29.9 | 52.1 | 63.1 | 68.5 | 100.0 | 38.2 |
| Little Qualicum | | 0.2 | 2.1 | 10.5 | 21.8 | 30.7 | 24.3 | 8.1 | 2.3 | | 100.0 |
| | | 19.3 | 28.6 | 42.5 | 47.3 | 38.3 | 27.3 | 19.6 | 17.1 | | 32.5 |
| Nanaimo | 10.5 | 12.1 | 18.3 | 21.8 | 19.6 | 10.3 | 7.4 | | | | 100.0 |
| | 48.7 | 52.0 | 60.3 | 80.0 | 92.2 | 73.3 | 65.2 | | | | 66.1 |
| Cowichan | | | | 1.9 | 9.8 | 23.6 | 34.9 | 16.9 | 7.9 | | 100.0 |
| | | | | 19.0 | 47.4 | 75.9 | 99.6 | 99.6 | 99.5 | | 73.7 |
| Saltery Bay | | | 3.6 | 11.8 | 20.9 | 25.3 | 17.4 | 18.1 | 2.9 | | 100.0 |
| | | | 20.7 | 17.4 | 21.0 | 20.1 | 23.9 | 27.0 | 27.8 | | 21.5 |
| Squamish | | | | 22.5 | 23.1 | 31.6 | 19.0 | 3.8 | | | 100.0 |
| | | | | 68.0 | 48.8 | 72.0 | 39.3 | 18.6 | | | 46.1 |
| Cheakamus | | | 4.2 | 14.9 | 22. | 20.3 | 25.5 | 10.9 | 2.0 | | 100.0 |
| | | | 18.6 | 29.8 | 31.1 | 30.7 | 35.0 | 35.5 | 18.6 | | 30.6 |
| Stave | | 11.5 | 19.8 | 24.6 | 21.6 | 15.6 | 6.9 | | | | 100.0 |
| | | 31.0 | 25.2 | 33.9 | 26.1 | 16.1 | 7.2 | | | | 16.9 |
| Harrison | | 3.9 | 7.4 | 7.1 | 9.0 | 11.9 | 22.3 | 17.2 | 14.6 | 6.6 | 100.0 |
| | | 19.2 | 17.4 | 17.8 | 19.8 | 22.4 | 42.2 | 45.8 | 64.6 | 74.9 | 30.9 |
| Squakum | | | 16.4 | 31.2 | 20.3 | 20.4 | 7.7 | 4.0 | | | 100.0 |
| | | | 4.2 | 8.6 | 4.9 | 4.2 | 1.6 | 1.2 | | | 3.4 |

Table 26 (cont'd)

| Population | To Sept. 16 | Early Sept. 23 | Early Sept. 30 | Middle Oct. 7 | Middle Oct. 14 | Middle Oct. 21 | Late Oct. 28 | Late Nov. 4 | Late Nov. 11 | From Nov. 18 | All weeks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chehalis | | 17.3 | 27.2 | 7.6 | 11.8 | 15.5 | 9.7 | 9.1 | 1.8 | | 100.0 |
| | | 20.2 | 15.0 | 4.5 | 6.1 | 6.8 | 4.4 | 5.8 | 1.8 | | 7.3 |
| Vedder | | 6.8 | 11.7 | 13.1 | 15.0 | 15.6 | 24.5 | 11.2 | 2.1 | | 100.0 |
| | | 21.9 | 17.8 | 21.5 | 21.5 | 19.1 | 30.4 | 19.5 | 6.0 | | 20.2 |

Table 27. Annual exploitation rates (%) of study area stocks for 1965 to 1970.

| Sub-area stock population | Year | | | | | | All |
|---|---|---|---|---|---|---|---|
| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | |
| Upper Vancouver Island | 1.9 | 20.0 | 76.0 | 48.9 | 32.9 | 70.7 | 46.5 |
| Kingcome to Knight Inlet | 18.5 | 26.3 | 15.5 | 41.5 | 1.3 | 28.7 | 24.6 |
| Upper Johnstone Strait | 0.0 | 0.0 | 1.9 | 3.0 | 1.4 | 1.8 | 1.6 |
| Lower Johnstone Strait | 0.0 | 0.0 | 3.7 | 15.6 | 15.3 | 38.2 | 15.3 |
| Loughborough to Bute Inlet | 0.0 | 0.0 | 4.0 | 18.7 | 26.9 | 34.2 | 23.4 |
| Mid-Vancouver Island | 0.0 | 0.0 | 14.2 | 25.9 | 31.0 | 32.0 | 25.1 |
| Puntledge | - | - | - | - | - | - | 26.8 |
| Big Qualicum | - | - | - | - | - | - | 23.6 |
| Little Qualicum | - | - | - | - | - | - | 26.4 |
| Toba Inlet | 0.0 | 0.0 | 11.4 | 24.9 | 41.5 | 61.9 | 25.5 |
| Jervis Inlet | 0.0 | 0.0 | 18.2 | 22.5 | 29.5 | 36.8 | 26.1 |
| Saltery Bay | - | - | - | - | - | - | 25.8 |
| Lower Vancouver Island | 0.0 | 0.0 | 12.8 | 24.6 | 38.9 | 54.8 | 29.7 |
| Nanaimo | - | - | - | - | - | - | 28.9 |
| Southern Vancouver Island | 0.0 | 0.0 | 16.5 | 35.3 | 34.0 | 43.6 | 23.8 |
| Cowichan | - | - | - | - | - | - | 25.6 |
| Howe Sound & Burrard Inlet | 0.0 | 0.0 | 17.5 | 21.1 | 36.0 | 38.1 | 28.3 |
| Squamish | - | - | - | - | - | - | 31.1 |
| Cheakamus | - | - | - | - | - | - | 28.5 |
| Fraser River | 6.9 | 4.3 | 31.8 | 37.1 | 44.6 | 60.1 | 37.5 |
| Stave | - | - | - | - | - | - | 34.0 |
| Harrison | - | - | - | - | - | - | 37.7 |
| Squakum | - | - | - | - | - | - | 33.8 |
| Chehalis | - | - | - | - | - | - | 38.9 |
| Vedder | - | - | - | - | - | - | 39.8 |
| TOTAL | 7.8 | 6.3 | 23.2 | 33.5 | 37.1 | 47.0 | 32.2 |

Table 28. Distribution and fishing intensities (%) by fishery of study area stocks for 1965 to 1970.

| Area | Distribution | | | Exploitation rate |
|---|---|---|---|---|
| | Abundance | Catch | Escapement | |
| Study area | 100.0 | | | |
| Goletas Channel | 0.8 | 46.5 | 53.5 | 46.5 |
| Kingcome Inlet | 1.5 | 28.3 | 71.7 | 28.3 |
| Bond to Knight | 5.1 | 23.5 | 76.5 | 23.5 |
| Upper Johnstone Strait | 92.6 | | | |
| Upper Johnstone St. | 12.2 | 87.0 | 13.0 | 87.0 |
| Lower Johnstone Strait | 80.4 | | | |
| Lower Johnstone St. | 14.3 | 72.9 | 27.1 | 72.9 |
| Texada Island | 66.1 | | | |
| Texada Island (A14, 15, 16) | 18.5 | 5.4 | 94.6 | 5.4 |
| South Strait of Georgia | 47.6 | | | |
| South St. of Georgia (17, 18, 28) | 13.9 | 4.0 | 96.0 | 4.0 |
| Fraser River | 33.7 | | | |
| Fraser River | 33.7 | 22.7 | 77.3 | 22.7 |
| ALL | 100.0 | 32.2 | 67.8 | 32.2 |

Table A1. Lapsed days from tagging at upper Johnstone Strait to dead recovery on spawning grounds (sample size in brackets).

| Tag Week Ending | 1965 | | | 1966 | | | 1967 | | | 1968 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance |
| Sept. 23 | 29.5 | 30.0 (4) | 12.7 | 36.5 | 38.1 (8) | 64.4 | - | - | - | - | - | - |
| Sept. 30 | 37.0 | 35.8 (14) | 74.6 | 40.0 | 38.8 (12) | 133.4 | 42.0 | 39.4 (5) | 35.3 | 46.5 | 47.8 (20) | 137.7 |
| Oct. 7 | 35.0 | 31.3 (3) | 52.3 | 48.0 | 45.3 (3) | 30.3 | 43.0 | 45.7 (53) | 90.7 | 47.0 | 48.4 (18) | 165.7 |
| Oct. 14 | 43.0 | 39.0 (9) | 174.8 | 42.5 | 45.9 (12) | 101.4 | 49.0 | 50.0 (20) | 90.3 | 47.0 | 47.6 (90) | 130.7 |
| Oct. 21 | 41.0 | 39.6 (13) | 52.8 | 54.0 | 59.1 (15) | 427.4 | 46.0 | 46.7 (41) | 187.4 | 46.0 | 44.7 (21) | 95.9 |
| Oct. 28 | 45.5 | 45.1 (36) | 156.7 | 64.0 | 60.0 (21) | 151.6 | 49.0 | 50.3 (22) | 152.8 | 48.5 | 50.1 (22) | 109.8 |
| Nov. 4 | 49.0 | 48.9 (33) | 191.3 | 58.0 | 57.4 (34) | 52.6 | 43.0 | 45.5 (59) | 96.5 | - | - | - |
| Nov. 11 & 18 | - | - | - | 53.0 | 52.9 (17) | 30.6 | - | - | - | 46.0 | 46.0 (21) | 101.6 |
| All weeks | 45.0 | 43.0 (112) | 166.1 | 54.0 | 52.9 (122) | 149.3 | 46.0 | 46.6 (200) | 118.9 | 48.0 | 47.5 (192) | 124.1 |

Table A1 (cont'd)

| Tag Week Ending | 1969 Median | 1969 Mean | 1969 Variance | 1970 Median | 1970 Mean | 1970 Variance | All years Mean | All years Variance |
|---|---|---|---|---|---|---|---|---|
| Sept. 23 | 44.0 | 45.0 (16) | 194.3 | - | - | - | 40.9 (28) | 155.9 |
| Sept. 30 | 41.5 | 41.3 (6) | 42.3 | 52.5 | 49.8 (26) | 147.4 | 44.1 (83) | 142.4 |
| Oct. 7 | 43.0 | 44.0 (84) | 111.5 | 44.0 | 46.5 (322) | 114.6 | 45.9 (484) | 113.9 |
| Oct. 14 | 42.0 | 43.8 (94) | 125.5 | 44.0 | 46.0 (344) | 157.5 | 45.9 (569) | 146.1 |
| Oct. 21 | 43.5 | 41.7 (34) | 86.3 | 47.0 | 48.5 (137) | 153.1 | 47.1 (261) | 166.6 |
| Oct. 28 | 43.0 | 44.2 (55) | 136.8 | 53.0 | 52.1 (229) | 99.2 | 50.5 (385) | 129.6 |
| Nov. 4 | 44.5 | 45.4 (36) | 135.1 | 50.0 | 47.6 (155) | 174.6 | 48.1 (317) | 153.9 |
| Nov. 11 & 18 | 39.0 | 45.0 (9) | 271.5 | 42.0 | 42.4 (156) | 75.1 | 43.8 (203) | 89.9 |
| All weeks | 44.0 | 43.9 (335) | 124.1 | 50.0 | 47.2 (1369) | 136.0 | 46.8 (2330) | 139.1 |

Table A2. Lapsed days from tagging at lower Johnstone Strait to dead recovery on spawning grounds (sample size in brackets).

| Tag week ending | 1962 | | | 1967 | | | 1969 | | | All years | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Mean | Variance |
| Sept. 23 | 38.0 | 39.2 (5) | 14.7 | - | - | - | - | - | - | 39.2 (5) | 14.7 |
| Sept. 30 | 37.0 | 38.6 (24) | 74.5 | - | - | - | - | - | - | 38.6 (24) | 74.5 |
| Oct. 7 | 39.5 | 38.3 (28) | 117.4 | - | - | - | 42.0 | 42.5 (130) | 124.5 | 41.7 (158) | 125.8 |
| Oct. 14 | 41.0 | 45.7 (26) | 237.7 | - | - | - | 40.0 | 41.0 (392) | 130.3 | 41.3 (418) | 138.3 |
| Oct. 21 | 44.5 | 45.5 (44) | 217.6 | - | - | - | 40.0 | 40.3 (184) | 119.0 | 41.3 (228) | 141.4 |
| Oct. 28 | 42.0 | 46.1 (20) | 206.9 | - | - | - | 40.0 | 40.1 (25) | 157.6 | 42.8 (45) | 184.4 |
| Nov. 4 | 46.0 | 47.5 (104) | 169.6 | 43.0 | 43.7 (236) | 140.9 | - | - | - | 44.9 (340) | 152.3 |
| Nov. 11 | 44.0 | 43.0 (40) | 121.3 | 42.0 | 43.5 (271) | 111.4 | - | - | - | 43.4 (311) | 78.2 |
| Nov. 18 | 36.0 | 36.7 (13) | 79.4 | - | - | - | - | - | - | 36.7 (13) | 79.4 |
| All week | 45.5 | 44.2 (304) | 170.8 | 42.0 | 43.6 (507) | 124.9 | 40.0 | 41.1 (731) | 127.4 | 42.5 (1542) | 98.9 |

Table A3. Lapsed days from tagging at Texada Island to dead recovery on spawning grounds (sample size in brackets).

| Tag week ending | 1970 | | |
|---|---|---|---|
| | Median | Mean | Variance |
| Oct. 28 | 40.0 | 37.4 (22) | 247.2 |
| Nov. 4 | 42.0 | 41.7 (153) | 158.8 |
| Nov. 11 | 43.0 | 41.8 (129) | 119.5 |
| All weeks | 42.0 | 41.4 (304) | 148.5 |

Table A4. Summary of lapsed days from tagging at upper and lower Johnstone Strait and Texada Island to marine recovery for years 1962 and 1967 to 1970.

| Marine recovery | | | | |
|---|---|---|---|---|
| General area | Statistical area | Tags recovered | Mean days | Median days |
| | From upper Johnstone Strait | | | |
| Upper Johnstone Strait | 12 | 1,467 | 5.7 | 4.0 |
| Lower Johnstone Strait | 13 | 1,668 | 7.7 | 5.0 |
| North/central Georgia St. | 14,15,16 | 327 | 15.6 | 14.0 |
| Southern Georgia St. | 17,18,29 | 778 | 22.8 | 23.0 |
| Washington State | | 115 | 18.2 | 17.0 |
| | From lower Johnstone Strait | | | |
| Upper Johnstone Strait | 12 | 32 | 8.0 | 5.0 |
| Lower Johnstone Strait | 13 | 220 | 4.6 | 3.0 |
| North/central Georgia St. | 14,15,16 | 218 | 12.0 | 10.0 |
| Southern Georgia St. | 17,18,29 | 607 | 16.1 | 16.0 |
| Washington State | | 76 | 17.1 | 16.0 |
| | From Texada Island | | | |
| Lower Johnstone Strait | 13 | 10 | 14.8 | 4.0 |
| North/central Georgia St. | 14,15,16 | 224 | 4.4 | 3.0 |
| Southern Georgia St. | 17,18,29 | 175 | 16.1 | 18.0 |
| Washington State | | 14 | 7.1 | 8.0 |

Table A5. Lapsed days from tagging at upper Johnstone Strait to marine recovery by statistical area during years 1967 to 1970 inclusive (sample size in brackets).

| Statistical area of recovery | 1967 | | | 1968 | | | 1969 | | | 1970 | | | All years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median |
| 12 | 4.8 (26) | 2.8 | 2.0 | 5.5 (50) | 33.8 | 4.0 | 6.0 (141) | 33.0 | 4.0 | 5.7 (1250) | 27.8 | 4.0 | 5.7 (1467) | 28.0 | 4.0 |
| 13 | 5.8 (62) | 7.9 | 5.0 | 7.5 (54) | 13.7 | 6.0 | 6.7 (387) | 27.8 | 5.0 | 8.1 (1165) | 39.1 | 6.0 | 7.7 (1668) | 35.0 | 5.0 |
| 14 | 23.8 (4) | 134.9 | 12.0 | - | | | 17.4 (9) | 45.3 | 16.0 | 18.8 (26) | 134.1 | 8.0 | 19.0 (39) | 111.4 | 16.0 |
| 15 | - | | | 30.0 (1) | | | - | | | 11.6 (63) | 72.6 | 10.0 | 11.9 (64) | 76.7 | 10.0 |
| 16 | 40.5 (2) | 60.5 | 35.0 | 34.0 (6) | 20.0 | 34.0 | 19.7 (22) | 110.4 | 6.0 | 14.9 (194) | 63.0 | 14.0 | 16.1 (224) | 82.1 | 15.0 |
| 17 | - | | | - | | | 11.3 (11) | 3.2 | 11.0 | 16.0 (65) | 78.2 | 11.0 | 15.4 (76) | 72.7 | 11.0 |
| 18 | | | | 27.0 (5) | 96.5 | 28.0 | 24.0 (1) | | | 18.7 (3) | 14.3 | 17.0 | 23.9 (9) | 68.1 | 23.0 |
| 29 | 22.9 (71) | 66.3 | 21.0 | 24.8 (77) | 88.5 | 21.0 | 21.8 (88) | 114.9 | 19.0 | 23.8 (457) | 79.9 | 23.0 | 23.6 (693) | 84.2 | 23.0 |
| 34 | 21.5 (29) | 91.4 | 19.0 | 16.3 (25) | 62.4 | 17.0 | 16.6 (30) | 56.6 | 15.0 | 18.1 (31) | 49.1 | 17.0 | 18.2 (115) | 67.2 | 17.0 |

Table A6. Lapsed days from tagging at lower Johnstone Strait to marine recovery by statistical area during years 1962, 1967 and 1969 (sample size in brackets).

| Statistical area of recovery | 1962 | | | 1967 | | | 1969 | | | All years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median |
| 12 | 5.8 (5) | 6.7 | 5.0 | - | | | 8.4 (27) | 27.9 | 5.0 | 8.0 (32) | 25.2 | 5.0 |
| 13 | 4.3 (29) | 13.6 | 3.0 | 1.1 (45) | 1.4 | 1.0 | 5.7 (146) | 26.2 | 5.0 | 4.6 (220) | 22.8 | 3.0 |
| 14 | 11.6 (37) | 78.6 | 9.0 | 15.9 (11) | 29.3 | 17.0 | 16.8 (8) | 41.9 | 17.0 | 13.2 (56) | 67.1 | 10.0 |
| 15 | 31.5 (2) | 4.5 | 30.0 | - | | | - | | | 31.5 (2) | 4.5 | 30.0 |
| 16 | 7.5 (126) | 30.8 | 6.0 | - | | | 26.0 (34) | 19.0 | 26.0 | 11.4 (160) | 85.8 | 10.0 |
| 17 | 12.6 (9) | 199.8 | 9.0 | - | | | 37.1 (7) | 317.8 | 41.0 | 23.3 (16) | 392.3 | 9.0 |
| 18 | 13.0 (32) | 49.1 | 12.0 | - | | | 31.3 (6) | 159.9 | 34.0 | 15.3 (38) | 96.0 | 12.0 |
| 29 | 14.1 (195) | 42.1 | 13.0 | 16.5 (304) | 10.9 | 16.0 | 20.7 (54) | 67.4 | 20.0 | 16.0 (553) | 30.9 | 16.0 |
| 34 | 14.1 (14) | 104.3 | 13.0 | 16.6 (34) | 28.9 | 16.0 | 19.2 (28) | 62.3 | 20.0 | 17.1 (76) | 56.7 | 16.0 |

Table A7. Lapsed days from tagging at Texada Island to marine recovery by statistical area during 1970 (sample size in brackets).

| Statistical area of recovery | 1970 | | |
|---|---|---|---|
| | Mean | Variance | Median |
| 13 | 14.8 (10) | 96.0 | 4.0 |
| 14 | 5.6 (7) | 46.9 | 4.0 |
| 15 | 3.8 (96) | 9.7 | 3.0 |
| 16 | 4.9 (121) | 15.2 | 3.0 |
| 17 | 3.9 (25) | 7.7 | 3.0 |
| 18 | 16.0 (1) | 0 | |
| 29 | 18.2 (149) | 29.9 | 18.0 |
| 34 | 7.1 (14) | 10.7 | 8.0 |

Table A8. Lapsed days from tagging at Qualicum/Baynes Sound to marine recovery by statistical area during years 1967 and 1969 (sample size in brackets).

| Statistical area of recovery | 1967 | | | 1969 | | | All years | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median |
| 14 | 7.2 (25) | 47.1 | 9.5 | 6.6 (36) | 31.2 | 6 | 6.8 (61) | 37.1 | 7 |

Table A9. Lapsed days from tagging at upper Johnstone Strait to dead recovery on spawning grounds for years 1967 to 1970, inclusive.

| Stocks/populations | 1967 | | | 1968 | | | 1969 | | | 1970 | | | All years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance |
| Middle Vancouver Island | 94 | 46.5 | 108.4 | 60 | 49.9 | 116.2 | 141 | 45.2 | 126.8 | 759 | 49.2 | 101.3 | 1054 | 48.5 | 106.5 |
| Puntledge | 4 | 46.5 | 29.6 | - | - | - | 21 | 44.6 | 160.5 | 79 | 43.8 | 108.6 | 104 | 44.1 | 119.5 |
| Big Qualicum River | 46 | 46.0 | 69.0 | 21 | 46.5 | 37.3 | 48 | 46.7 | 100.9 | 263 | 50.8 | 76.3 | 378 | 49.5 | 77.2 |
| Little Qualicum River | 32 | 48.6 | 157.1 | 37 | 51.8 | 111.3 | 63 | 44.0 | 116.0 | 355 | 48.8 | 109.2 | 487 | 48.4 | 114.3 |
| Jervis Inlet | 6 | 38.6 | 142.7 | 31 | 40.2 | 50.9 | 44 | 39.9 | 97.6 | 111 | 41.0 | 78.1 | 192 | 40.6 | 81.9 |
| Saltery Bay | 5 | 36.8 | 142.7 | 28 | 39.6 | 50.9 | 36 | 38.0 | 55.6 | 65 | 39.8 | 69.1 | 134 | 39.2 | 66.4 |
| Lower Vancouver Island | 9 | 47.2 | 304.9 | 7 | 37.7 | 105.9 | 20 | 36.5 | 75.1 | 105 | 43.6 | 76.1 | 141 | 42.6 | 94.7 |
| Nanaimo | 3 | 48.6 | 366.3 | 2 | 35.0 | 128.0 | 3 | 35.6 | 0.3 | 51 | 44.4 | 72.2 | 59 | 43.9 | 91.6 |
| Southern Vancouver Island | 7 | 48.2 | 137.9 | 2 | 55.0 | 18.0 | 4 | 55.5 | 93.6 | 15 | 50.8 | 158.2 | 28 | 51.2 | 156.2 |
| Howe Sound | 12 | 60.2 | 158.3 | 12 | 49.3 | 89.3 | 30 | 49.3 | 80.2 | 51 | 55.3 | 212.7 | 105 | 53.5 | 160.7 |
| Squamish | 2 | 57.0 | 0.0 | 8 | 58.2 | 77.4 | 6 | 55.1 | 106.0 | 7 | 45.1 | 41.3 | 23 | 52.8 | 88.7 |
| Cheakamus | 9 | 62.5 | 183.7 | 4 | 47.7 | 130.9 | 14 | 47.4 | 76.0 | 19 | 60.8 | 294.2 | 46 | 55.9 | 210.3 |
| Fraser River | 72 | 44.8 | 81.0 | 76 | 48.8 | 137.8 | 90 | 43.2 | 115.6 | 208 | 49.6 | 98.0 | 446 | 47.4 | 106.4 |
| Stave | 3 | 36.0 | 43.0 | 10 | 42.9 | 79.4 | 14 | 41.0 | 40.5 | 38 | 39.5 | 54.9 | 65 | 40.2 | 58.4 |
| Harrison | 31 | 46.9 | 52.3 | 31 | 51.7 | 128.3 | 24 | 53.3 | 80.6 | 100 | 50.8 | 78.0 | 186 | 50.5 | 82.8 |
| Chehalis | 4 | 42.2 | 112.5 | 8 | 45.5 | 131.2 | 21 | 36.8 | 84.2 | 15 | 53.4 | 147.6 | 48 | 43.8 | 124.6 |
| Squakum | 14 | 44.0 | 64.0 | 9 | 46.1 | 113.3 | 11 | 41.3 | 73.6 | 13 | 45.3 | 47.2 | 47 | 44.2 | 77.6 |
| Vedder | 13 | 43.5 | 116.7 | 14 | 54.2 | 222.0 | 11 | 45.4 | 146.4 | 33 | 56.0 | 147.3 | 71 | 51.8 | 156.7 |

Table A10. Lapsed days from tagging at lower Johnstone Strait to dead recovery on spawning grounds for years 1962, 1967 and 1969.

| Stocks/populations | 1962 | | | 1967 | | | 1969 | | | All years | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance |
| Middle Vancouver Island | 128 | 41.9 | 121.7 | 284 | 42.6 | 102.4 | 263 | 44.4 | 121.8 | 675 | 43.2 | 115.9 |
| Puntledge | 11 | 43.8 | 270.7 | 23 | 42.6 | 235.4 | 56 | 42.6 | 78.3 | 90 | 42.8 | 140.1 |
| Big Qualicum River | 76 | 40.6 | 95.3 | 127 | 38.9 | 51.1 | 34 | 45.4 | 62.5 | 237 | 40.4 | 66.9 |
| Little Qualicum River | 34 | 43.8 | 86.1 | 79 | 40.7 | 104.3 | 151 | 44.3 | 140.6 | 264 | 43.1 | 122.9 |
| Jervis Inlet | 4 | 59.7 | 180.5 | 29 | 35.5 | 77.9 | 102 | 40.9 | 119.4 | 135 | 40.3 | 111.6 |
| Saltery Bay | | | | 22 | 32.0 | 45.6 | 87 | 38.7 | 91.4 | 109 | 37.3 | 83.7 |
| Lower Vancouver Island | 25 | 35.9 | 33.7 | 4 | 46.7 | 121.3 | 51 | 32.8 | 60.9 | 80 | 34.4 | 51.8 |
| Nanaimo | 7 | 33.0 | 52.6 | 1 | 60.0 | | 15 | 31.4 | 14.1 | 23 | 33.1 | 25.6 |
| Southern Vancouver Island | 14 | 48.6 | 99.5 | 27 | 48.4 | 270.5 | 9 | 53.6 | 146.7 | 50 | 49.4 | 200.0 |
| Howe Sound | 33 | 57.7 | 184.2 | 47 | 45.1 | 62.0 | 33 | 48.8 | 136.8 | 113 | 49.8 | 119.3 |
| Squamish | 15 | 63.6 | 200.1 | 17 | 42.7 | 95.7 | 6 | 54.8 | 54.0 | 38 | 52.9 | 150.2 |
| Cheakamus | 18 | 52.8 | 126.1 | 30 | 46.4 | 40.3 | 14 | 44.3 | 27.9 | 62 | 47.8 | 62.3 |
| Fraser River | 96 | 43.9 | 138.4 | 104 | 47.2 | 68.9 | 230 | 40.8 | 68.4 | 430 | 43.0 | 80.1 |
| Stave | | | | | | | 54 | 37.7 | 58.1 | 54 | 37.7 | 58.1 |
| Harrison | 55 | 45.6 | 95.1 | 70 | 49.0 | 61.7 | 47 | 41.8 | 86.9 | 172 | 46.0 | 80.6 |
| Chehalis | 10 | 46.7 | 252.9 | 3 | 50.0 | 1.0 | 44 | 40.7 | 65.4 | 57 | 42.3 | 100.1 |
| Squakum | 8 | 31.7 | 98.7 | 2 | 40.5 | 40.5 | 25 | 42.6 | 67.7 | 35 | 40.0 | 80.1 |
| Vedder | 14 | 42.1 | 131.0 | 17 | 47.7 | 84.6 | 29 | 45.0 | 108.0 | 60 | 45.1 | 106.7 |

Table A11. Lapsed days and dates of recovery for tags applied at the upper and lower Johnstone Strait tag sites and recovered at Cottonwood, Fraser River, test-fishing.

| | | Tagged week ending October 14 | | | | | | Tagged from week starting October 15 | | | | | | Seasonal | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Date of recovery | | | Days out from tagging | | | Date of recovery | | | Days out from tagging | | | Dates of recovery | | | Lapsed days | | |
| Year | N | Median | Mean | Variance | Median | Mean | Variance | N | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance | Median | Mean | Variance |
| | | | | | | | | | | Upper Johnstone Strait | | | | | | | | | |
| 1970 | 14 | 298.0 | 303.6 | 104.6 | 22.5 | 23.0 | 42.6 | 14 | 325.5 | 329.4 | 109.6 | 28.0 | 28.1 | 34.0 | 317.5 | 316.5 | 276.5 | 26.0 | 25.6 | 43.7 |
| 1969 | 0 | | | | | | | 1 | | 321.0 | | | 18.0 | | | | | | | |
| 1968 | 4 | 302.0 | 300.8 | 22.3 | 19.0 | 19.0 | 11.3 | 4 | 330.0 | 330.0 | 6.0 | 26.0 | 25.5 | 23.0 | 316.0 | 315.4 | 256.6 | 21.5 | 22.3 | 26.8 |
| 1967 | 0 | | | | | | | 1 | | 319.0 | | | 28.0 | | | | | | | |
| 1966 | 6 | 291.0 | 288.7 | 44.7 | 20.5 | 19.2 | 23.8 | 4 | 322.0 | 327.0 | 152.0 | 26.5 | 26.8 | 24.3 | 294.5 | 304.0 | 467.3 | 21.5 | 22.2 | 36.6 |
| 1965 | 2 | 292.0 | 292.0 | 2.0 | 21.0 | 21.0 | 2.0 | 11 | 327.0 | 325.7 | 102.0 | 22.0 | 22.2 | 48.6 | 324.0 | 320.5 | 245.6 | 22.0 | 22.0 | 40.8 |
| ALL | 26 | 297.0 | 298.8 | 107.8 | 20.5 | 21.3 | 31.9 | 35 | 326.5 | 327.5 | 92.6 | 26.0 | 25.5 | 39.9 | 319.0 | 315.3 | 302.2 | 23.0 | 23.7 | 40.2 |
| | | | | | | | | | | Lower Johnstone Strait | | | | | | | | | |
| 1969 | 9 | 299.0 | 299.4 | 51.5 | 20.0 | 18.1 | 29.9 | 2 | 305.5 | 305.5 | 40.5 | 17.0 | 17.0 | 50.0 | 299.0 | 300.5 | 51.3 | 19.0 | 17.9 | 29.1 |
| 1967 | 0 | | | | | | | 11 | 332.0 | 333.0 | 27.4 | 24.0 | 24.0 | 25.5 | | | | | | |
| 1962 | 5 | 291.0 | 291.6 | 88.8 | 13.0 | 14.2 | 12.7 | 8 | 33.0 | 328.4 | 188.6 | 24.0 | 21.5 | 60.9 | 329.0 | 314.2 | 486.4 | 20.0 | 18.7 | 53.4 |
| ALL | 14 | 299.0 | 296.6 | 74.2 | 19.0 | 16.7 | 26.1 | 21 | 332.0 | 328.6 | 145.7 | 24.0 | 22.6 | 41.9 | 327.0 | 315.8 | 366.7 | 20.0 | 20.2 | 43.1 |

Table A12. Lapsed days to spawning ground dead recovery for the Fraser River populations from tagging at upper and lower Johnstone Strait.

| | | Upper Johnstone Strait | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tagged to Oct. 14 | | | Tagged after Oct. 14 | | | Seasonal | | |
| Locations | Year | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance |
| Stave | 1970 | 34 | 39.9 | 62.1 | 4 | 36.5 | 79.0 | 38 | 39.5 | 54.9 |
| | 1969 | 12 | 42.5 | 8.9 | 2 | 32.5 | 0.0 | 14 | 41.1 | 40.5 |
| | 1968 | 10 | 42.9 | 79.4 | - | - | - | 10 | 42.9 | 79.4 |
| | 1967 | 3 | 36.0 | 43.0 | - | - | - | 3 | 36.0 | 43.0 |
| | All | 59 | 40.7 | 53.6 | 6 | 35.2 | 79.0 | 65 | 40.2 | 58.4 |
| Harrison | 1970 | 32 | 50.2 | 66.7 | 68 | 51.1 | 57.7 | 100 | 50.8 | 78.0 |
| | 1969 | 7 | 51.6 | 43.3 | 17 | 54.1 | 35.9 | 24 | 53.4 | 80.6 |
| | 1968 | 17 | 49.3 | 102.9 | 14 | 53.3 | 11.8 | 31 | 51.1 | 128.3 |
| | 1967 | 15 | 41.9 | 40.5 | 16 | 51.8 | 26.2 | 31 | 47.0 | 52.3 |
| | All | 71 | 48.4 | 67.8 | 115 | 51.9 | 44.9 | 186 | 50.5 | 82.9 |
| Chehalis | 1970 | 7 | 58.0 | 10.3 | 8 | 49.5 | 128.8 | 15 | 53.5 | 147.7 |
| | 1969 | 20 | 36.8 | 83.1 | 1 | 33.0 | - | 21 | 36.8 | 84.2 |
| | 1968 | 8 | 45.5 | 131.2 | - | - | - | 8 | 45.5 | 131.2 |
| | 1967 | 1 | 42.0 | - | 3 | 42.3 | 165.3 | 4 | 42.3 | 112.5 |
| | All | 36 | 43.0 | 80.0 | 12 | 46.3 | 136.9 | 48 | 43.8 | 124.6 |
| Squakum | 1970 | 11 | 45.5 | 34.0 | 2 | 44.0 | 0.0 | 13 | 45.3 | 47.2 |
| | 1969 | 9 | 39.9 | 77.1 | 2 | 48.0 | 0.0 | 11 | 41.4 | 73.7 |
| | 1968 | 9 | 46.1 | 113.4 | - | - | - | 9 | 46.1 | 113.4 |
| | 1967 | 13 | 44.7 | 57.5 | 1 | 35.0 | 0.0 | 14 | 44.0 | 64.0 |
| | All | 42 | 44.2 | 67.2 | 5 | 43.8 | 28.2 | 47 | 44.2 | 77.7 |
| Vedder | 1970 | 19 | 52.2 | 151.8 | 14 | 61.1 | 61.0 | 33 | 56.0 | 147.4 |
| | 1969 | 7 | 46.3 | 259.4 | 4 | 44.0 | 56.3 | 11 | 45.5 | 146.5 |
| | 1968 | 12 | 55.3 | 254.3 | 2 | 48.5 | 0.0 | 14 | 54.3 | 222.0 |
| | 1967 | 8 | 44.3 | 85.9 | 5 | 42.4 | 163.6 | 13 | 43.5 | 116.8 |
| | All | 46 | 50.7 | 183.0 | 25 | 53.6 | 76.9 | 71 | 51.8 | 156.7 |
| Fraser R. | 1970 | 109 | 47.8 | 103.8 | 99 | 51.6 | 86.9 | 208 | 49.6 | 98.0 |
| | 1969 | 65 | 41.1 | 100.3 | 25 | 48.9 | 72.5 | 90 | 43.2 | 115.7 |
| | 1968 | 58 | 47.6 | 151.2 | 18 | 53.1 | 138.0 | 76 | 48.9 | 137.9 |
| | 1967 | 43 | 43.6 | 72.9 | 29 | 46.7 | 106.1 | 72 | 44.9 | 81.1 |
| Stave | 1969 | 44 | 38.3 | 54.3 | 10 | 35.3 | 72.7 | 54 | 37.8 | 58.2 |
| | 1967 | - | - | - | - | - | - | - | - | - |
| | 1962 | - | - | - | - | - | - | - | - | - |
| | All | 44 | 38.3 | 54.3 | 10 | 35.3 | 72.7 | 54 | 37.8 | 58.2 |
| Harrison | 1969 | 33 | 41.7 | 59.4 | 14 | 40.7 | 51.4 | 47 | 41.9 | 86.9 |
| | 1967 | - | - | - | 70 | 49.1 | 64.7 | 70 | 49.1 | 61.5 |
| | 1962 | 10 | 35.5 | 29.5 | 45 | 47.9 | 86.0 | 55 | 45.7 | 95.2 |
| | All | 43 | 40.2 | 52.9 | 129 | 47.8 | 70.8 | 172 | 46.0 | 80.7 |

Table A12 (cont'd)

| | | Lower Johnstone Strait | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Tagged to Oct. 14 | | | Tagged after Oct. 14 | | | Seasonal | | |
| Locations | Year | N | Mean | Variance | N | Mean | Variance | N | Mean | Variance |
| Chehalis | 1969 | 36 | 40.1 | 56.7 | 8 | 43.6 | 63.1 | 44 | 40.8 | 65.4 |
| | 1967 | - | - | - | 3 | 50.0 | 1.0 | 3 | 50.0 | 1.0 |
| | 1962 | 6 | 37.2 | 103.0 | 4 | 61.0 | 110.3 | 10 | 46.7 | 252.9 |
| | All | 42 | 39.7 | 62.5 | 15 | 49.5 | 64.5 | 57 | 42.3 | 100.2 |
| Squakum | 1969 | 22 | 42.1 | 68.2 | 3 | 47.0 | 111.0 | 25 | 42.6 | 67.8 |
| | 1967 | - | - | - | 2 | 40.5 | 0.0 | 2 | 40.5 | 0.0 |
| | 1962 | 5 | 37.0 | 42.3 | 3 | 23.0 | 49.0 | 8 | 31.8 | 98.8 |
| | All | 27 | 41.2 | 64.0 | 8 | 36.4 | 64.0 | 35 | 40.0 | 80.2 |
| Vedder | 1969 | 21 | 45.4 | 98.9 | 8 | 38.8 | 78.6 | 29 | 45.0 | 108.0 |
| | 1967 | - | - | - | 17 | 47.7 | 69.3 | 17 | 47.7 | 69.3 |
| | 1962 | 7 | 37.7 | 156.7 | 7 | 46.6 | 170.0 | 14 | 42.1 | 131.0 |
| | All | 28 | 43.5 | 110.4 | 32 | 45.2 | 89.6 | 60 | 45.1 | 106.7 |
| Fraser River | 1969 | 185 | 41.0 | 67.0 | 45 | 40.4 | 66.7 | 230 | 40.9 | 68.4 |
| | 1967 | - | - | - | 104 | 47.2 | 68.9 | 104 | 47.2 | 68.9 |
| | 1962 | 33 | 37.7 | 74.3 | 63 | 47.2 | 143.7 | 96 | 43.9 | 138.4 |
| | All | 218 | 40.0 | 68.7 | 212 | 45.8 | 90.9 | 430 | 43.0 | 80.1 |

Table A13. Lapsed days from tagging at Qualicum Baynes Sound to dead recovery on spawning grounds (sample size in brackets).

| Tag week ending | 1967 | | | 1969 | | | All years | |
|---|---|---|---|---|---|---|---|---|
| | Median | Mean | Variance | Median | Mean | Variance | Mean | Variance |
| Oct. 21 | 40.0 | 42.9 (239) | 208.4 | | | | 42.9 (239) | 208.4 |
| Oct. 28 | 43.0 | 45.4 (131) | 387.6 | 31.0 | 34.4 (67) | 228.5 | 41.7 (198) | 359.1 |
| Nov. 4 | 39.0 | 42.2 (113) | 315.9 | 28.5 | 30.9 (178) | 137.6 | 36.3 (291) | 197.6 |
| Nov. 11 | 30.0 | 35.2 (96) | 250.0 | 32.0 | 35.4 (65) | 82.0 | 35.3 (161) | 181.2 |
| Nov. 18 | 25.0 | 25.6 (362) | 70.0 | 30.0 | 30.9 (67) | 118.5 | 27.4 (429) | 81.1 |
| Nov. 25 | 21.0 | 22.5 (297) | 79.3 | 23.0 | 23.6 9456) | 76.2 | 23.2 (753) | 77.6 |
| Dec. 2 | 19.0 | 23.1 (157) | 84.8 | 21.0 | 21.1 (603) | 57.5 | 21.5 (760) | 63.7 |
| All weeks | 30.0 | 31.5 (1395) | 235.5 | 24.0 | 24.9 (1436) | 106.9 | 28.1 (2831) | 181.1 |

Table A14. Lapsed days from tagging at Texada Island to dead recovery on spawning grounds for 1970.

| Stock/population | N | Mean | Variance |
|---|---|---|---|
| Middle Vancouver Island | 197 | 40.3 | 109.9 |
| Big Qualicum | 98 | 44.0 | 77.1 |
| Little Qualicum | 90 | 35.6 | 113.5 |
| Jervis Inlet | 26 | 32.2 | 128.6 |
| Saltery | 18 | 31.8 | 109.1 |
| Howe Sound | 10 | 47.3 | 53.1 |
| Fraser River | 31 | 48.0 | 99.8 |
| Harrison | 25 | 46.4 | 99.8 |

Table A15. Lapsed days from tagging at Qualicum-Baynes Sound during 1967 and 1969 to dead recovery on spawning grounds for main populations of middle Vancouver Island stock. (Sample size in brackets.)

| | Oct. 21 | | Oct. 28 | | Nov. 4 | | Nov. 11 | | Nov. 18 | | Nov. 25 | | Dec. 2 | | All weeks | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population | Mean | Variance | Mean | Variance | Mean | Variance | Mean | Variance | Mean | Variance | Mean | Variance | Mean | Variance | Mean | Variance |
| Puntledge | 39.0 (3) | 93.0 | 37.6 (25) | 145.6 | 30.3 (56) | 80.4 | 29.9 (74) | 250.6 | 30.7 (3) | 242.0 | 36.7 (3) | 614.3 | | | 31.5 (164) | 175.0 |
| Rosewall | | | 34.8 (12) | 411.5 | 35.3 (3) | 196.3 | 29.8 (6) | 53.0 | 25.3 (3) | 40.3 | | | | | 32.4 (24) | 311.6 |
| Cook-McNaughton | 66.7 (3) | 208.3 | 52.3 (72) | 449.4 | 48.3 (48) | 298.7 | 38.3 (71) | 122.7 | 31.5 (64) | 113.1 | 29.3 (17) | 75.6 | 26.2 (9) | 30.3 | 41.7 (284) | 252.7 |
| Big Qualicum | 40.2 (22) | 144.1 | 35.8 (35) | 80.7 | 36.2 (103) | 76.2 | 30.8 (6) | 79.0 | 24.7 (324) | 53.8 | 22.6 (629) | 55.1 | 20.7 (609) | 52.7 | 23.6 (1728) | 75.2 |
| Little Qualicum | 41.0 (195) | 150.7 | 34.4 946) | 319.1 | 28.6 (72) | 127.0 | | | 27.4 (25) | 76.2 | 22.6 (89) | 157.8 | 21.8 (111) | 81.4 | 31.2 (358) | 213.5 |

Table A16. Mean date and variance of spawning ground recoveries from all tag sites for years 1962, and 1965 to 1970.

| | Dead recoveries | | | Live recoveries | | |
|---|---|---|---|---|---|---|
| | N | Mean | Variance | N | Mean | Variance |
| Bond-Knight inlets | 17 | 298.9 | 232.1 | - | | |
| Kakweikan | 5 | 276.8 | 125.2 | | | |
| Glendale | 10 | 311.3 | 100.9 | | | |
| Upper Johnstone Strait | 23 | 348.7 | 93.1 | | | |
| Nimpkish | 23 | 348.7 | 93.1 | | | |
| Lower Johnstone Strait | 67 | 310.1 | 97.0 | | | |
| Hyacinth | 8 | 321.6 | 97.3 | | | |
| Kanish | 21 | 315.1 | 10.3 | | | |
| Granite | 21 | 303.7 | 12.4 | | | |
| Loughborough to Bute Inlet | 61 | 319.3 | 20.2 | | | |
| Heyon | 61 | 319.3 | 20.2 | | | |
| Mid-Vancouver Island | 4,794 | 344.7 | 252.7 | | | |
| Puntledge | 371 | 335.8 | 283.2 | | | |
| Tsable | 7 | 327.0 | 128.9 | | | |
| Coal | 7 | 332.4 | 48.2 | | | |
| Rosewall | 54 | 341.5 | 420.5 | | | |
| Cook-McNaughton | 372 | 352.6 | 241.5 | | | |
| Big Qualicum | 2,456 | 347.7 | 120.6 | 191 | 334.9 | 87.1 |
| Little Qualicum | 1,396 | 339.4 | 208.5 | | | |
| Englishman | 24 | 331.2 | 126.7 | 7 | 315.6 | 202.6 |
| Toba Inlet | 16 | 354.0 | 51.2 | | | |
| Sliammon | 14 | 366.9 | 57.9 | | | |
| Jervis Inlet | 392 | 329.3 | 163.9 | | | |
| Kelly | 12 | 328.2 | 108.2 | | | |
| Lang | 5 | 323.0 | 46.9 | | | |
| Halfmoon Bay | 5 | 343.0 | 95.4 | | | |
| Simpkins | 9 | 323.9 | 11.1 | | | |
| Gillies Bay | 5 | 328.2 | 60.2 | | | |
| Deserted | 18 | 329.9 | 48.6 | | | |
| Thunder Bay | 14 | 331.1 | 101.4 | | | |
| Saltery Bay | 275 | 328.2 | 151.7 | | | |
| Roberts | 14 | 333.1 | 184.1 | | | |
| Lower Vancouver Island | 254 | 318.6 | 218.5 | | | |
| Nanoose | 25 | 317.2 | 87.1 | | | |
| Bowell | 36 | 319.3 | 160.5 | | | |
| Nanaimo | 102 | 319.6 | 172.8 | | | |
| Holland | 24 | 308.5 | 76.9 | | | |
| Stocking Lake | 32 | 321.7 | 179.8 | | | |

Table A16 (cont'd)

| | Dead recoveries | | | Live recoveries | | |
|---|---|---|---|---|---|---|
| | N | Mean | Variance | N | Mean | Variance |
| Bush | 21 | 311.0 | 271.7 | | | |
| Chemainus | 17 | 315.2 | 131.1 | | | |
| Southern Vancouver Island | 98 | 350.8 | 295.7 | | | |
| Goldstream | 24 | 332.5 | 59.0 | 12 | 324.9 | 75.1 |
| Cowichan | 68 | 358.7 | 201.8 | 9 | 339.6 | 277.8 |
| Howe Sound | 234 | 344.9 | 237.9 | | | |
| Roberts | 4 | 338.5 | 349.7 | | | |
| Mamquam | 28 | 352.4 | 90.4 | | | |
| Squamish | 57 | 348.9 | 226.0 | 13 | 329.8 | 218.3 |
| Cheakamus | 113 | 346.2 | 167.2 | | | |
| West Bay | 19 | 324.7 | 190.2 | | | |
| Fraser River | 1,076 | 338.0 | 352.5 | | | |
| Pitt | 5 | 313.8 | 132.7 | | | |
| Alouette | 7 | 319.9 | 86.5 | | | |
| Stave | 131 | 321.7 | 61.1 | 23 | 307.3 | 21.8 |
| Norrish | 4 | 351.7 | 250.9 | | | |
| Inches | 26 | 344.4 | 90.8 | | | |
| Nicomen | 3 | 352.3 | 225.4 | | | |
| Harrison | 440 | 347.5 | 315.8 | 17 | 331.9 | 474.3 |
| Squakum | 93 | 324.6 | 100.1 | | | |
| Chehalis | 124 | 329.5 | 325.3 | | | |
| Weaver | 61 | 340.2 | 489.5 | | | |
| Vedder | 158 | 339.6 | 373.7 | 8 | 325.5 | 375.3 |
| Mainstem | 20 | 334.7 | 760.6 | | | |

Table B1. Distribution of recovered marine and spawning ground tags for tags applied each week at Bond-Knight Inlet during 1970.

| | Tag week ending | | | | |
|---|---|---|---|---|---|
| | Aug 19 | Aug 26 | Sep 2 | Sep 9 | All weeks |
| | Spawning grounds recoveries | | | | |
| Bond-Knight Inlet | - | 1 | 1 | 3 | 5 |
| | Marine recoveries | | | | |
| Upper Johnstone Strait | - | - | 1 | 1 | 2 |
| Bond-Knight Inlet | 2 | - | 1 | 19 | 22 |
| Total recovered | 2 | 1 | 3 | 23 | 29 |
| Tags applied | 21 | 22 | 14 | 77 | 134 |

Table B2. Distribution of recovered marine and spawning ground tags for tags applied each week at Bond-Knight Inlet during 1968.

| | Tag week ending | | | | | | |
|---|---|---|---|---|---|---|---|
| | Jul 15 | Jul 22 | Jul 29 | Aug 5 | Aug 12 | Sep 9 | All weeks |
| | Spawning grounds | | | | | | |
| Bond-Knight Inlet | | | | | | | |
| Marine recoveries | | | | | | | |
| Upper Johnstone Strait | 1 | | | | | | 1 |
| Bond-Knight Inlet | 72 | 28 | 50 | 20 | 13 | | 183 |
| Total recovered | 73 | 28 | 50 | 20 | 13 | 2 | 186 |
| Tags applied | 140 | 44 | 66 | 36 | 18 | 12 | 296 |

Table 83. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1970.

| Recovery area | Tag week ending | | | | | | | All weeks |
|---|---|---|---|---|---|---|---|---|
| | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | |
| **Spawning grounds recoveries** | | | | | | | | |
| Bond-Knight Inlet | 2 | 3 | 5 | 1 | | | | 11 |
| Upper Johnstone Strait | | | | | 2 | 1 | 22 | 25 |
| Lower Johnstone Strait | 1 | 3 | 5 | | | | | 9 |
| Loughborough to Bute Inlet | 4 | 28 | 25 | 4 | | | | 61 |
| Mid-Vancouver Island | 5 | 138 | 170 | 96 | 213 | 126 | 103 | 851 |
| Toba Inlet | | 3 | 2 | 1 | | | | 6 |
| Jervis Inlet | 1 | 46 | 38 | 13 | 8 | 6 | 3 | 115 |
| Lower Vancouver Island | 10 | 50 | 42 | 5 | 2 | | | 109 |
| Southern Vancouver Island | 1 | 4 | 10 | 3 | | | | 20 |
| Howe Sound | | 12 | 27 | 5 | 16 | 6 | 5 | 71 |
| Fraser River | 2 | 72 | 63 | 24 | 17 | 23 | 39 | 240 |
| Washington State | | | | | 1 | 1 | | 2 |
| Sub-total | 26 | 359 | 387 | 152 | 259 | 163 | 174 | 1,520 |
| **Marine recoveries** | | | | | | | | |
| Upper Vancouver Island | | | 4 | 2 | | | | 6 |
| Bond-Knight Inlet | | | 4 | 2 | 1 | | | 7 |
| Upper Johnstone Strait | 44 | 65 | 530 | 238 | 262 | 168 | 38 | 1,345 |
| Loughborough-Bute Inlet | | | 2 | 2 | | | | 4 |
| Lower Johnstone Strait | 19 | 105 | 514 | 154 | 338 | 109 | | 1,239 |
| Toba Inlet | | 11 | 31 | 8 | 14 | 2 | | 66 |
| Jervis Inlet | | 1 | | 1 | | | | 2 |
| East Texada Island | 2 | 28 | 35 | 16 | 22 | 2 | 2 | 107 |
| West Texada Island (16) | 2 | 11 | 14 | 24 | 36 | 5 | | 92 |
| West Texada Island (14) | | 2 | 3 | 2 | 4 | | | 11 |
| Mid-Vancouver Island | | 1 | 3 | 5 | 5 | 1 | | 15 |
| Lower Vancouver Island | 2 | 10 | 12 | 5 | 35 | 1 | | 65 |
| Southern Vancouver Island | | | | 1 | 1 | 1 | | 3 |
| Fraser River | 12 | 60 | 43 | 46 | 164 | 118 | 55 | 498 |
| Washington State | | | 2 | 3 | 6 | 3 | | 14 |
| Sub-total | 81 | 294 | 1,199 | 507 | 888 | 410 | 95 | 3,474 |
| Total recovered | 107 | 653 | 1,586 | 659 | 1,147 | 573 | 269 | 4,994 |
| Tags applied | 313 | 2,128 | 3,688 | 1,508 | 2,406 | 1,430 | 1,920 | 13,393 |

Table B4. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1969.

| Recovery area | Tag week ending | | | | | | | | All weeks |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | |
| **Spawning ground recoveries** | | | | | | | | | |
| Lower Johnstone Strait | | 1 | 5 | 1 | | | | | 7 |
| Mid-Vancouver Island | 4 | 3 | 19 | 47 | 22 | 36 | 26 | 5 | 162 |
| Jervis Inlet | 3 | 1 | 12 | 17 | 4 | 8 | 8 | | 53 |
| Lower Vancouver Island | 7 | 2 | 16 | 6 | 1 | | | | 32 |
| Southern Vancouver Is. | | | 2 | 3 | | 2 | | 1 | 8 |
| Howe Sound | 2 | 2 | 6 | 12 | 5 | 9 | | | 36 |
| Fraser River | 7 | 7 | 38 | 19 | 5 | 11 | 7 | 4 | 98 |
| Washington State | | | | | | 1 | | | 1 |
| Sub-total | 23 | 16 | 98 | 105 | 37 | 67 | 41 | 10 | 397 |
| **Marine recoveries** | | | | | | | | | |
| Upper Johnstone Strait | 16 | 13 | 1 | 7 | 45 | 42 | 36 | 1 | 161 |
| Loughborough-Bute Inlet | 1 | | | | | | | | 1 |
| Lower Johnstone Strait | 23 | 24 | 7 | 52 | 145 | 112 | 53 | | 416 |
| East Texada Island | | | 2 | 4 | 2 | 5 | 3 | | 16 |
| West Texada Island (16) | | 1 | | 1 | | | 3 | 1 | 6 |
| West Texada Island (14) | | | | 1 | | | | | 1 |
| Mid-Vancouver Island | 1 | | | 4 | 1 | 1 | | 1 | 8 |
| Lower Vancouver Island | 2 | 1 | 4 | | | 1 | 3 | | 11 |
| Southern Vancouver Island | | | | | | 1 | | | 1 |
| Fraser River | 22 | 21 | 6 | 18 | 12 | 26 | 12 | 3 | 120 |
| Washington State | | | | | 1 | 1 | | | 2 |
| Sub-total | 65 | 60 | 20 | 87 | 206 | 189 | 110 | 6 | 743 |
| Total recovered | 88 | 76 | 118 | 192 | 243 | 256 | 151 | 16 | 1,140 |
| Tags applied | 431 | 261 | 708 | 900 | 632 | 734 | 438 | 141 | 4,245 |

Table B5. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1968.

| Recovery area | Tag week ending | | | | | | | All weeks |
|---|---|---|---|---|---|---|---|---|
| | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | |
| **Spawning grounds recoveries** | | | | | | | | |
| Lower Johnstone Strait | | | 1 | | | | | 1 |
| Mid-Vancouver Island | 2 | 7 | 26 | 11 | 14 | 1 | 7 | 68 |
| Toba Inlet | | | | | 1 | | | 1 |
| Jervis Inlet | | 3 | 20 | 7 | 4 | 1 | 2 | 37 |
| Lower Vancouver Island | 3 | 1 | 5 | | | | | 9 |
| Southern Vancouver Island | | | 1 | | 1 | | | 2 |
| Juan de Fuca | | 1 | | | | | | 1 |
| Howe Sound | 1 | 3 | 5 | 1 | 1 | | 2 | 13 |
| Fraser River | 19 | 7 | 38 | 3 | 4 | | 11 | 82 |
| Sub-total | 25 | 22 | 96 | 22 | 25 | 2 | 22 | 214 |
| **Marine recoveries** | | | | | | | | |
| Upper Johnstone Strait | | 1 | 2 | 24 | 22 | 4 | | 53 |
| Loughborough-Bute Inlet | 1 | | | | 1 | | | 2 |
| Lower Johnstone Strait | 2 | 1 | 8 | 18 | 26 | | | 55 |
| Toba Inlet | | | 2 | | | | 1 | 3 |
| Jervis Inlet | 1 | 3 | 2 | | | | | 6 |
| Southern Vancouver Island | | | | 2 | 1 | | 2 | 5 |
| Fraser River | 11 | 5 | 25 | 13 | 19 | 2 | 29 | 104 |
| Sub-total | | | | | | | | |
| Total recoveries | 40 | 32 | 135 | 79 | 94 | 8 | 54 | 442 |
| Tags applied | 301 | 301 | 774 | 275 | 378 | 31 | 257 | 2,307 |

Table B6. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1967.

| Recovery area | Tag week ending | | | | | | All weeks |
|---|---|---|---|---|---|---|---|
| | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | |
| **Spawning grounds recoveries** | | | | | | | |
| Mid-Vancouver Island | 1 | 9 | 14 | 19 | 20 | 41 | 104 |
| Jervis Inlet | | 2 | | 4 | | | 6 |
| Lower Vancouver Island | 1 | 5 | 1 | 2 | 1 | 1 | 11 |
| Southern Vancouver Island | | 1 | | 3 | 1 | 3 | 8 |
| Howe Sound | | 3 | 2 | 6 | | 3 | 14 |
| Fraser River | 3 | 37 | 4 | 20 | 5 | 16 | 85 |
| Sub-total | 5 | 57 | 21 | 54 | 27 | 64 | 228 |
| **Marine recoveries** | | | | | | | |
| Upper Vancouver Island | | | | 3 | | | 3 |
| Upper Johnstone Strait | | | | 20 | | 3 | 23 |
| Lower Johnstone Strait | 1 | | 1 | 47 | 3 | 10 | 62 |
| East Texada Island (16) | | | | 1 | 1 | | 2 |
| West Texada Island (14) | | | | | | 1 | 1 |
| Mid-Vancouver Island | | 1 | | 1 | 1 | | 3 |
| Fraser River | 9 | 18 | 3 | 8 | 23 | 40 | 101 |
| Sub-total | 10 | 19 | 4 | 80 | 28 | 54 | 195 |
| Total recoveries | 15 | 76 | 25 | 134 | 55 | 118 | 423 |
| Tags applied | 103 | 597 | 171 | 487 | 175 | 467 | 2,128 |

Table B7. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1966.

| Recovery area | Tag week ending | | | | | | | | All weeks |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 16/23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11/18 | |
| **Spawning grounds recoveries** | | | | | | | | | |
| Mid-Vancouver Island | | | | 1 | 5 | 4 | 6 | 3 | 19 |
| Jervis Inlet | | | 1 | 3 | 5 | 4 | | | 13 |
| Lower Vancouver Island | 10 | 6 | | 1 | | | 2 | 1 | 20 |
| Southern Vancouver Is. | | | | | | 2 | | 1 | 3 |
| Fraser River | 3 | 6 | 3 | 10 | 7 | 17 | 33 | 17 | 96 |
| Sub-total | 13 | 12 | 4 | 15 | 17 | 27 | 41 | 22 | 151 |
| **Marine recoveries** | | | | | | | | | |
| Lower Johnstone Strait | | | | | 2 | 2 | | | 4 |
| Lower Vancouver Island | | | | | | 1 | | | 1 |
| Fraser River | 15 | 8 | | 1 | 2 | 2 | 1 | 2 | 31 |
| Washington State | 1 | 1 | | 1 | | 2 | 3 | 1 | 9 |
| Sub-total | 16 | 9 | 0 | 2 | 4 | 7 | 4 | 3 | 45 |
| Total recoveries | 29 | 21 | 4 | 17 | 21 | 34 | 45 | 25 | 196 |
| Tags applied | 163 | 188 | 127 | 253 | 166 | 258 | 341 | 184 | 1,680 |

Table B8. Distribution of recovered marine and spawning ground tags for tags applied each week at upper Johnstone Strait during 1965.

| Recovery area | Tag week ending | | | | | | | All Weeks |
|---|---|---|---|---|---|---|---|---|
| | Sep 23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | |
| **Spawning ground recoveries** | | | | | | | | |
| Upper Johnstone Strait | | | | | | 1 | | 1 |
| Lower Johnstone Strait | | 1 | | | | | | 1 |
| Mid-Vancouver Island | | | | 2 | 2 | 17 | 15 | 36 |
| Jervis Inlet | | | | 2 | 5 | 5 | 3 | 15 |
| Lower Vancouver Island | 1 | 7 | 1 | 2 | | | | 11 |
| Southern Vanc. Island | | | | | | 1 | 5 | 6 |
| Howe Sound | | 2 | | | | | 1 | 3 |
| Fraser River | 3 | 11 | 2 | 5 | 8 | 21 | 23 | 73 |
| Washington State | | | | | | 1 | | 1 |
| Sub-total | 4 | 21 | 3 | 11 | 15 | 46 | 47 | 147 |
| **Marine recoveries** | | | | | | | | |
| Upper Johnstone Strait | | 2 | | | | | 1 | 3 |
| Lower Johnstone Strait | | 2 | | | 1 | 4 | 2 | 9 |
| Fraser River | 1 | 18 | 1 | | 2 | 6 | 11 | 39 |
| Washington State | 1 | | | | | | | 1 |
| Sub-total | 2 | 22 | 1 | 0 | 3 | 10 | 14 | 52 |
| Total recoveries | 6 | 43 | 4 | 11 | 18 | 56 | 61 | 199 |
| Tags applied | 63 | 299 | 35 | 170 | 282 | 405 | 360 | 1,614 |

Table B9. Distribution of recovered marine and spawning ground tags for tags applied each week at lower Johnstone Strait during 1969.

| Recovery area | Tag week ending | | | | All weeks |
|---|---|---|---|---|---|
| | Oct 7 | Oct 14 | Oct 21 | Oct 28 | |
| **Spawning ground recoveries** | | | | | |
| Lower Johnstone Strait | 14 | 21 | 8 | | 43 |
| Mid-Vancouver Island | 43 | 139 | 101 | 19 | 302 |
| Jervis Inlet | 20 | 73 | 32 | 4 | 129 |
| Lower Vancouver Island | 14 | 40 | 6 | | 60 |
| Southern Vancouver Is. | 4 | 5 | 8 | | 17 |
| Howe Sound | 7 | 30 | 13 | 3 | 53 |
| Fraser River | 56 | 146 | 43 | 4 | 249 |
| Washington State | | | 1 | | 1 |
| Sub-total | 158 | 454 | 212 | 30 | 854 |
| **Marine recoveries** | | | | | |
| Upper Johnstone Strait | | 5 | 21 | 3 | 29 |
| Lower Johnstone Strait | 14 | 43 | 71 | 21 | 149 |
| East Texada Island | 1 | 9 | 8 | 1 | 19 |
| West Texada Island (16) | | 7 | 5 | 3 | 15 |
| West Texada Island (14) | 1 | 1 | | | 2 |
| Mid-Vancouver Island | 2 | 2 | 2 | | 6 |
| Lower Vancouver Island | 3 | 3 | 2 | | 8 |
| Southern Vancouver Is. | | 2 | 2 | 2 | 6 |
| Fraser River | 11 | 34 | 20 | 11 | 76 |
| Washington State | 1 | 4 | 2 | | 7 |
| Sub-total | 33 | 110 | 133 | 41 | 317 |
| Total recovered | 191 | 564 | 345 | 71 | 1,171 |
| Tags applied | 944 | 2,702 | 1,275 | 254 | 5,175 |

Table B10. Distribution of recovered marine and spawning ground tags for tags applied each week at lower Johnstone Strait during 1967.

| Recovery area | Tag week ending Nov 4 | Nov 11 | All weeks |
|---|---|---|---|
| **Spawning ground recoveries** | | | |
| Lower Johnstone Strait | 1 | | 1 |
| Mid-Vancouver Island | 147 | 163 | 310 |
| Jervis Inlet | 16 | 14 | 30 |
| Lower Vancouver Island | 4 | 3 | 7 |
| Southern Vancouver Island | 15 | 17 | 32 |
| Howe Sound | 19 | 28 | 47 |
| Fraser River | 50 | 66 | 116 |
| Washington State | 6 | 5 | 11 |
| Sub-total | 258 | 296 | 554 |
| **Marine recoveries** | | | |
| Lower Johnstone Strait | 20 | 25 | 45 |
| Mid-Vancouver Island | 4 | 7 | 11 |
| Fraser River | 152 | 152 | 304 |
| Washington State | 13 | 21 | 34 |
| Sub-total | 189 | 205 | 394 |
| Total recoveries | 447 | 501 | 948 |
| Tags applied | 1,293 | 1,707 | 3,000 |

Table B11. Distribution of recovered marine and spawning ground tags for tags applied each week at lower Johnstone Strait during 1962.

| Recovery area | Tag week ending | | | | | | | | All weeks |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11/18 | |
| **Spawning ground recoveries** | | | | | | | | | |
| Lower Johnstone Strait | | | 1 | | | | | | 1 |
| Mid-Vancouver Island | | 3 | 4 | 12 | 23 | 8 | 62 | 24 | 136 |
| Jervis Inlet | 1 | | | | 1 | 1 | 1 | 1 | 5 |
| Lower Vancouver Island | 1 | 13 | 9 | 2 | 1 | | | | 26 |
| Southern Vancouver Is. | | | | | | 2 | 9 | 5 | 16 |
| Howe Sound | | | 1 | 7 | 8 | | 13 | 5 | 34 |
| Burrard Inlet | | | | | 1 | | | | 1 |
| Fraser River | 4 | 12 | 13 | 7 | 10 | 9 | 26 | 20 | 101 |
| Washington State | | | | | | 1 | 1 | | 2 |
| Sub-total | 6 | 28 | 28 | 28 | 44 | 21 | 112 | 55 | 322 |
| **Marine recoveries** | | | | | | | | | |
| Upper Vancouver Island | | 1 | 1 | | | | | | 2 |
| Bond-Knight Inlet | | | | 1 | | | | | 1 |
| Upper Johnstone Strait | | | | | 3 | | | | 3 |
| Lower Johnstone Strait | | 5 | 1 | 3 | 21 | 1 | | | 31 |
| Toba Inlet | 2 | | | | | | | | 2 |
| East Texada Island | 2 | 7 | 4 | 22 | 43 | 1 | | | 79 |
| West Texada Island | 2 | 5 | | 8 | 36 | | | | 51 |
| Mid-Vancouver Island | 1 | 1 | 4 | 13 | 16 | | 1 | 2 | 38 |
| Lower Vancouver Island | | 1 | | 4 | 3 | | 1 | | 9 |
| Southern Vancouver Island | | | | 1 | 2 | 2 | 18 | 9 | 32 |
| Fraser River | 22 | 63 | 6 | 14 | 34 | 4 | 51 | 20 | 214 |
| Washington State | | | 1 | | 2 | 1 | 4 | 5 | 13 |
| Sub-total | 29 | 83 | 17 | 66 | 160 | 9 | 75 | 36 | 475 |
| Total recoveries | 35 | 111 | 45 | 94 | 204 | 30 | 187 | 91 | 797 |
| Tags applied | 164 | 455 | 279 | 566 | 809 | 141 | 711 | 290 | 3,415 |

Table B12. Distribution of recovered marine and spawning ground tags for tags applied each week at lower Johnstone Strait during 1967.

| Recovery area | Tag week ending | | | All weeks |
|---|---|---|---|---|
| | Oct 28 | Nov 4 | Nov 11 | |
| **Spawning ground recoveries** | | | | |
| Lower Johnstone Strait | | 1 | | 1 |
| Mid-Vancouver Island | 4 | 126 | 93 | 223 |
| Jervis Inlet | 3 | 4 | 6 | 13 |
| Lower Vancouver Island | 14 | 16 | 11 | 41 |
| Southern Vancouver Island | | | 3 | 3 |
| Howe Sound | | 4 | 1 | 5 |
| Fraser River | | 13 | 3 | 16 |
| Washington State | 3 | 14 | 21 | 38 |
| Sub-total | 24 | 178 | 138 | 340 |
| **Marine recoveries** | | | | |
| Upper Johnstone Strait | 7 | 1 | 8 | |
| Lower Johnstone Strait | 5 | 15 | 1 | 21 |
| Toba Inlet | 103 | 7 | 1 | 111 |
| East Texada Island | 102 | 19 | | 121 |
| West Texada Island (16) | 4 | 23 | 8 | 35 |
| West Texada Island (14) | | 4 | | 4 |
| Mid-Vancouver Island | | 3 | 1 | 4 |
| Lower Vancouver Island | 2 | 23 | | 25 |
| Southern Vancouver Island | | 1 | | 1 |
| Fraser River | 9 | 88 | 64 | 161 |
| Washington State | 2 | 5 | 1 | 8 |
| Sub-total | 227 | 195 | 77 | 499 |
| Total recovered | 251 | 373 | 215 | 839 |
| Tags applied | 448 | 854 | 522 | 1,824 |

Table B13. Distribution of recovered marine and spawning ground tags for tags applied each week at Qualicum-Baynes Sound during 1969.

| Recovery area | Tag week ending | | | | | | All weeks |
|---|---|---|---|---|---|---|---|
| | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | |
| | Spawning grounds recoveries | | | | | | |
| Mid-Vancouver Island | 73 | 216 | 172 | 137 | 487 | 619 | 1,704 |
| Fraser River | | 1 | | | | 1 | 2 |
| Sub-total | 73 | 217 | 172 | 137 | 487 | 620 | 1,706 |
| | Marine recoveries | | | | | | |
| Mid-Vancouver Island | 3 | 1 | 1 | | 30 | 1 | 36 |
| Fraser River | | | | 1 | | | 1 |
| Sub-total | 3 | 1 | 1 | 1 | 30 | 1 | 37 |
| Total recoveries | 76 | 218 | 173 | 138 | 517 | 621 | 1,743 |
| Tags applied | 339 | 956 | 500 | 361 | 1,074 | 1,452 | 4,682 |

Table B14. Distribution of recovered marine and spawning ground tags for tags applied each week at Qualicum-Baynes Sound during 1967.

| Recovery area | Tag week ending | | | | | | | All Weeks |
|---|---|---|---|---|---|---|---|---|
| | Oct 21 | Oct 28 | Nov 4 | Nov 11 | Nov 18 | Nov 25 | Dec 2 | |
| | | | Spawning ground recoveries | | | | | |
| Mid-Vancouver Island | 245 | 141 | 121 | 110 | 393 | 329 | 161 | 1,500 |
| Lower Vancouver Island | 2 | | | | | | | 2 |
| Southern Vanc. Island | 1 | | | | 1 | | | 2 |
| Fraser River | | | | | | 1 | | 1 |
| Sub-total | 248 | 141 | 121 | 110 | 394 | 330 | 161 | 1,505 |
| | | | Marine recoveries | | | | | |
| Mid-Vancouver Island | 6 | 9 | 7 | 1 | 2 | 0 | 0 | 25 |
| Sub-total | 6 | 9 | 7 | 1 | 2 | 0 | 0 | 25 |
| Total recovered | 254 | 150 | 128 | 111 | 396 | 330 | 161 | 1,530 |
| Tags applied | 732 | 470 | 309 | 820 | 725 | 651 | 375 | 4,082 |

Table B15. Distribution of recovered spawning ground tags for tags applied at upper Johnstone Strait 1965 to 1970.

| Recovery area | Tag week ending | | | | | | | | Tag totals |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 16/23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11/18 | |
| Bond to Knight inlets | | 2 | 3 | 5 | 1 | | | | 11 |
| Viner | | | | | 1 | | | | 1 |
| Kakweikan | | 1 | | | | | | | 1 |
| Glendale | | 1 | 3 | 5 | | | | | 9 |
| Upper Johnstone Strait | | | | | | 2 | 1 | 22 | 25 |
| Nimpkish | | | | | | 2 | 1 | 22 | 25 |
| Lower Johnstone Strait | 3 | 8 | 7 | | | | | | 18 |
| Hyacinth | 5 | | | | | | | | 5 |
| Campbell | | | 1 | | | | | | 1 |
| Kanish | | | 1 | 1 | | | | | 2 |
| Granite | | | 1 | | | | | | 1 |
| Loughborough to Bute inlets | | 4 | 28 | 25 | 4 | | | | 61 |
| Heydon | | 4 | 28 | 24 | 4 | | | | 60 |
| Mid-Vancouver Island | 4 | 11 | 173 | 260 | 156 | 304 | 214 | 118 | 1240 |
| Puntledge | 1 | 2 | 30 | 42 | 20 | 20 | 6 | 4 | 125 |
| Tsable | 1 | | 4 | 2 | | | | | 7 |
| Cougar | | 2 | | | | | | | 2 |
| Coal | | | | | | 1 | | | 1 |
| Waterloo | 1 | | | | | | | | 1 |
| Rosewall | | 3 | 8 | 4 | 1 | | | | 16 |
| Cook-McNaughton | | 1 | 8 | 7 | 8 | 9 | 10 | 2 | 45 |
| Big Qualicum | | | 14 | 44 | 49 | 167 | 143 | 86 | 503 |
| Little Qualicum | 1 | 4 | 94 | 156 | 76 | 106 | 54 | 26 | 517 |
| Englishman | 1 | | 11 | 4 | 2 | | | | 18 |

Table B15 (cont'd)

| Recovery area | Tag week ending | | | | | | | | Tag totals |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 16/23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11/18 | |
| Toba Inlet | | | 3 | 2 | 1 | 1 | | | 7 |
| Sliammon | | | | | 1 | 1 | | | 2 |
| Okeover | | | 3 | 2 | | | | | 5 |
| Jervis Inlet | 3 | 2 | 64 | 80 | 38 | 29 | 18 | 5 | 239 |
| Myrtle | 1 | | 1 | 1 | | | | | 3 |
| Kelly | | 1 | 6 | 5 | 1 | | | | 13 |
| Lang | | | 1 | 1 | | | | | 2 |
| Pender Harbour | 1 | | | 1 | | | | | 2 |
| Halfmoon Bay | | | 1 | | 2 | | | | 3 |
| Simpkins | | | 2 | 4 | 2 | | | | 8 |
| Gilles | | | 1 | 5 | 3 | 1 | | | 10 |
| Thunder Bay | | | 2 | 3 | 6 | 5 | | | 16 |
| Saltery Bay | 1 | 1 | 32 | 49 | 22 | 20 | 14 | 4 | 143 |
| Roberts | | | 1 | 2 | 1 | 3 | 1 | 1 | 9 |
| Deserted | | | 8 | 7 | 1 | | | | 16 |
| Skwawka | | | 4 | 1 | | | | | 5 |
| Lower Vancouver Island | 17 | 30 | 73 | 57 | 8 | 3 | 3 | 1 | 192 |
| Nanoose | 1 | 4 | 10 | 3 | | | | | 18 |
| Bonell | | 4 | 9 | 7 | | | | | 20 |
| Nanaimo | 2 | 9 | 30 | 31 | 2 | 1 | | | 75 |
| Holland | 2 | 4 | 5 | 3 | | | | | 14 |
| Stocking Lake | | 1 | | 5 | 8 | 4 | 1 | | 19 |
| Bush | 4 | 1 | | 7 | 1 | 1 | | | |
| Chemainus | | | | 6 | 3 | | | | 9 |
| Southern Vancouver Island | | 1 | 7 | 14 | 6 | 7 | 8 | 4 | 47 |
| Goldstream | | 1 | 7 | 10 | 2 | 2 | 2 | 1 | 25 |
| Cowichan | | | | 4 | 4 | 5 | 6 | 3 | 22 |

Table B15 (cont'd)

| Recovery area | Tag week ending | | | | | | | | Tag totals | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sep 16/23 | Sep 30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11/18 | | |
| Howe Sound | 2 | 5 | 24 | 46 | 17 | 26 | 10 | 7 | | 137 |
| Roberts | | | 2 | 2 | | 1 | | | 5 | |
| Mamquam | | | 1 | 4 | 2 | 6 | 3 | 4 | 20 | |
| Squamish | | | 8 | 11 | 6 | 5 | 1 | | 31 | |
| Cheakamus | 2 | 1 | 11 | 22 | 8 | 14 | 6 | 2 | 66 | |
| West Bay | 1 | 1 | 4 | 1 | | | | | 7 | |
| Fraser River | 13 | 48 | 159 | 139 | 67 | 75 | 102 | 71 | | 674 |
| Stave | 3 | 9 | 40 | 27 | 8 | 4 | | | 91 | |
| South Alouette | | 1 | 5 | | | | | | 6 | |
| Fraser Main Stem | | 1 | 2 | 6 | 4 | 1 | 2 | 2 | 18 | |
| Norrish | 1 | | | 1 | | | 2 | | 4 | |
| Inch | | | 1 | 4 | 3 | 2 | 3 | 1 | 14 | |
| Nicomen | | | 4 | 1 | | | | | 5 | |
| Harrison | 3 | 10 | 34 | 33 | 18 | 38 | 56 | 55 | 247 | |
| Squakum | | 5 | 34 | 17 | 7 | 3 | 3 | | 69 | |
| Chehalis | 4 | 11 | 11 | 13 | 7 | 5 | 9 | 2 | 62 | |
| Weaver | | 5 | 3 | 4 | 2 | 5 | 18 | 6 | 43 | |
| Vedder | 2 | 6 | 24 | 21 | 9 | 16 | 14 | 3 | 95 | |
| Washington State | | | | | | 3 | 1 | | | 4 |
| Bellingham | | | | | | 2 | | | 2 | |
| Skagit | | | | | | | 1 | | 1 | |
| Aberdeen | | | | | | 1 | | | 1 | |
| Totals | 39 | 106 | 542 | 635 | 298 | 450 | 357 | 228 | 2,658 | |

Table B16. Distribution of recovered spawning ground tags for tags applied at lower Johnstone Strait 1962, 1967, and 1969.

| Recovery area | Tag week ending | | | | | | | | Tag totals | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sep 23/30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | Nov 18 | | |
| Lower Johnstone Strait | | 15 | 21 | 8 | | | | | | 45 |
| Hyacinth | | 2 | 1 | | | | | | 3 | |
| Kanish | | 5 | 8 | 6 | | | | | 19 | |
| Granite Bay | | 7 | 12 | 2 | | | | | 21 | |
| Mid-Vancouver Island | 3 | 47 | 151 | 124 | 27 | 209 | 179 | 8 | | 748 |
| Puntledge | | 7 | 35 | 30 | 6 | 19 | 15 | | 112 | |
| Tsable | | 1 | 1 | | | | | | 2 | |
| Waterloo | 1 | | | | | | | | 1 | |
| Rosewall | | | 2 | | | 4 | 2 | | 8 | |
| Cook-McNaughton | | 3 | 6 | 3 | | 19 | 18 | 1 | 50 | |
| Big Qualicum | | 3 | 16 | 19 | 10 | 113 | 96 | 5 | 252 | |
| Little Qualicum | 2 | 31 | 82 | 68 | 11 | 48 | 38 | 1 | 281 | |
| Englishman | | 2 | 6 | 2 | | | 1 | 1 | 12 | |
| Jervis Inlet | | 20 | 74 | 33 | 5 | 17 | 15 | | | 165 |
| Myrtle | | 1 | 2 | | | | | | 3 | |
| Dayton | | 2 | 6 | 2 | | | | | 10 | |
| Kelly | | 1 | 7 | 2 | | | | | 9 | |
| Lang | | | 1 | | | | | | 1 | |
| Pender Harbour | | 2 | | | | | | | 2 | |
| Halfmoon Bay | | 1 | 1 | | | | | | 2 | |
| Gillies | | 3 | 1 | | | | | | 4 | |
| Saltery Bay | | 9 | 51 | 26 | 4 | 12 | 11 | | 113 | |
| Roberts | | | 2 | 1 | | | | | 3 | |
| Angus | | 1 | 1 | | | | | | 2 | |
| Lower Vancouver Island | 15 | 23 | 42 | 7 | | 4 | 3 | | | 94 |
| Nanoose | | 2 | 5 | | | | | 7 | | |
| Bonell | 3 | 5 | 6 | 1 | | | | 15 | | |

Table B16 (cont'd)

| Recovery area | Tag week ending | | | | | | | | Tag totals |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 23/30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | Nov 18 | |
| Nanaimo | 5 | 5 | 15 | 3 | | 1 | 1 | | 30 |
| Bonsall | | | | | | 1 | | | 1 |
| Holland | 1 | 4 | 4 | 1 | | | | | 10 |
| Stocking Lake | | 2 | 6 | 2 | | 2 | | | 12 |
| Bush | | 3 | 3 | | | | 1 | | 7 |
| Chemainus | 4 | 2 | 3 | | | | 1 | | 10 |
| Southern Vancouver Island | | 4 | 5 | 8 | 2 | 24 | 22 | | 65 |
| Goldstream | | 4 | 5 | 5 | | 1 | 2 | | 17 |
| Cowichan | | | | 3 | 2 | 22 | 20 | | 47 |
| Howe Sound | | 10 | 35 | 22 | 3 | 32 | 33 | | 135 |
| Roberts | | 2 | | | | | | | 2 |
| Squamish | | 4 | 16 | 10 | 2 | 14 | 11 | | 57 |
| Cheakamus | | | 12 | 10 | 1 | 18 | 22 | | 63 |
| West Bay | | 3 | 7 | 2 | | | | | 12 |
| Burrard Inlet | | | | 1 | | | | | 1 |
| Indian | | | | 1 | | | | | |
| Fraser River | 16 | 69 | 153 | 53 | 13 | 76 | 81 | 5 | 466 |
| Pitt | | 2 | 1 | 1 | | | | | 4 |
| South Alouette | | 1 | 1 | | | | | | 2 |
| Stave | | 16 | 36 | 10 | | 1 | | | 63 |
| Fraser Main Stem | | 3 | 3 | | | | 1 | | 7 |
| Inch | | | 2 | | 1 | 4 | 5 | | 12 |
| Nicomen | | | 1 | | | | | | 1 |
| Harrison | 3 | 12 | 29 | 16 | 8 | 54 | 57 | 4 | 183 |
| Chehalis | 4 | 7 | 30 | 9 | | 3 | 4 | | 57 |
| Squakum | 2 | 9 | 16 | 6 | | 1 | 1 | | 35 |
| Weaver | | 10 | 16 | 1 | | 2 | | | 29 |
| Vedder | 3 | 8 | 17 | 9 | 3 | 10 | 12 | 1 | 63 |

Table B16 (cont'd)

| Recovery area | Tag week ending | | | | | | | | Tag totals |
|---|---|---|---|---|---|---|---|---|---|
| | Sep 23/30 | Oct 7 | Oct 14 | Oct 21 | Oct 28 | Nov 4 | Nov 11 | Nov 18 | |
| Washington State | | | | 1 | 1 | 7 | 5 | | 14 |
| Bellingham | | | | 1 | | 3 | 1 | | 5 |
| Skagit | | | | | | 1 | | | 1 |
| Hood Canal | | | | | 1 | 3 | 4 | | 8 |
| Totals | 34 | 186 | 482 | 256 | 51 | 370 | 338 | 13 | 1730 |

Table B17. Distribution of spawning ground tags recovered for tags applied at Texada Island during 1970.

| Recovery area | Tag week ending | | | Tag totals | |
|---|---|---|---|---|---|
| | Oct 28 | Nov 4 | Nov 1 | | |
| Lower Johnstone Strait | | 1 | | | 1 |
| Campbell | | 1 | | 1 | |
| Mid-Vancouver Island | 4 | 126 | 93 | | 223 |
| Puntledge | | 1 | | 1 | |
| Rosewall | | | 1 | 1 | |
| Cook-McNaughton | | 4 | 1 | 5 | |
| Nile | | 1 | | 1 | |
| Big Qualicum | 1 | 58 | 58 | 117 | |
| Little Qualicum | 3 | 61 | 32 | 96 | |
| Englishman | | 1 | 1 | 2 | |
| Toba Inlet | 3 | 4 | 6 | | 13 |
| Sliammon | 3 | 4 | 6 | 13 | |
| Jervis Inlet | 14 | 16 | 11 | | 41 |
| Dayton | 1 | | | | |
| Kelly | | 1 | 1 | 2 | |
| Lang | 2 | | | | |
| Simpkins | 1 | | | | |
| Mouat Bay | | | 1 | 1 | |
| Saltery | 7 | 12 | 6 | 25 | |
| Roberts | | 2 | 2 | 4 | |
| Deserted | 1 | 1 | | 2 | |
| Lower Vancouver Island | | | 3 | 1 | 3 |
| Nanaimo | | | 1 | 1 | |
| Bonsall | | | 1 | 1 | |
| Southern Vancouver Island | | 4 | 1 | | 5 |
| Goldstream | | 1 | | 1 | |
| Cowichan | | 2 | 1 | 3 | |
| Howe Sound | | 14 | 4 | | 18 |
| Mamquam | | 7 | 1 | 8 | |
| Squamish | | 1 | 2 | 3 | |
| Cheakamus | | 5 | 1 | 6 | |
| Fraser River | 3 | 13 | 20 | | 36 |
| Stave | 1 | | | 1 | |
| Norrish | | | 1 | 1 | |
| Harrison | | 9 | 17 | 26 | |
| Chehalis | 1 | 1 | | 2 | |
| Vedder | 1 | 3 | 2 | 6 | |
| Totals | 24 | 178 | 138 | | 340 |

Table B18. Distribution of recovered spawning ground tags applied at Qualicum-Baynes Sound during 1967 and 1969.

| Recovery area | Tag week ending | | | | | | | Tag totals | |
|---|---|---|---|---|---|---|---|---|---|
| | Oct 21 | Oct 28 | Nov 4 | Nov 11 | Nov 18 | Nov 25 | Dec 2 | | |
| Mid-Vancouver Island | 245 | 214 | 337 | 282 | 530 | 816 | 780 | | 3204 |
| Puntledge | 4 | 31 | 67 | 90 | 4 | 3 | | 199 | |
| Tsable | 1 | | | | | | | 1 | |
| Cougar | | | | 1 | | | | 1 | |
| Coal | | 7 | | | 5 | | | 12 | |
| Waterloo | | | 2 | 1 | | | | 3 | |
| Rosesall | | 13 | 10 | 12 | 9 | | | 44 | |
| Cook-McNaughton | 3 | 73 | 70 | 166 | 114 | 17 | 9 | 452 | |
| Trent | | | | 1 | | | | 1 | |
| Big Qualicum | 23 | 38 | 109 | 6 | 356 | 679 | 622 | 1833 | |
| Little Qualicum | 202 | 49 | 77 | | 26 | 101 | 118 | 573 | |
| Lower Vancouver Island | 2 | | | | | | | | 2 |
| Bonell | 1 | | | | | | | 1 | |
| Nanaimo | 1 | | | | | | | 1 | |
| Southern Vancouver Island | 1 | | | | 1 | | | | 2 |
| Goldstream | 1 | | | | | | | 1 | |
| Cowichan | | | | | 1 | | | 1 | |
| Fraser River | | | 1 | | | 1 | 1 | | 3 |
| Harrison | | | | | | 1 | 1 | 2 | |
| Chehalis | | | 1 | | | | | 1 | |
| Total | 248 | 214 | 338 | 282 | 531 | 817 | 781 | | 3211 |

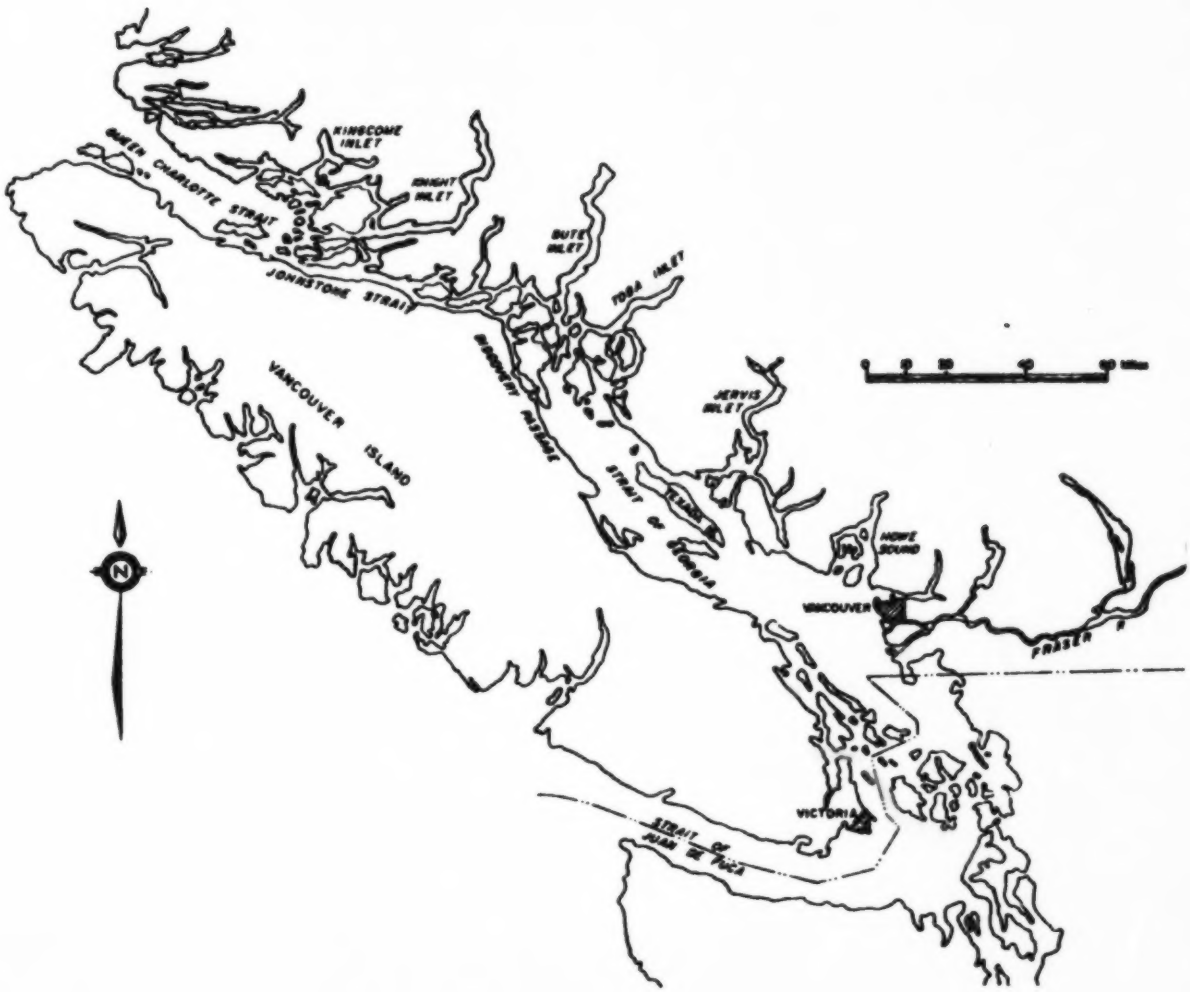


Fig. 1. Major geographic locations in the Study Area.

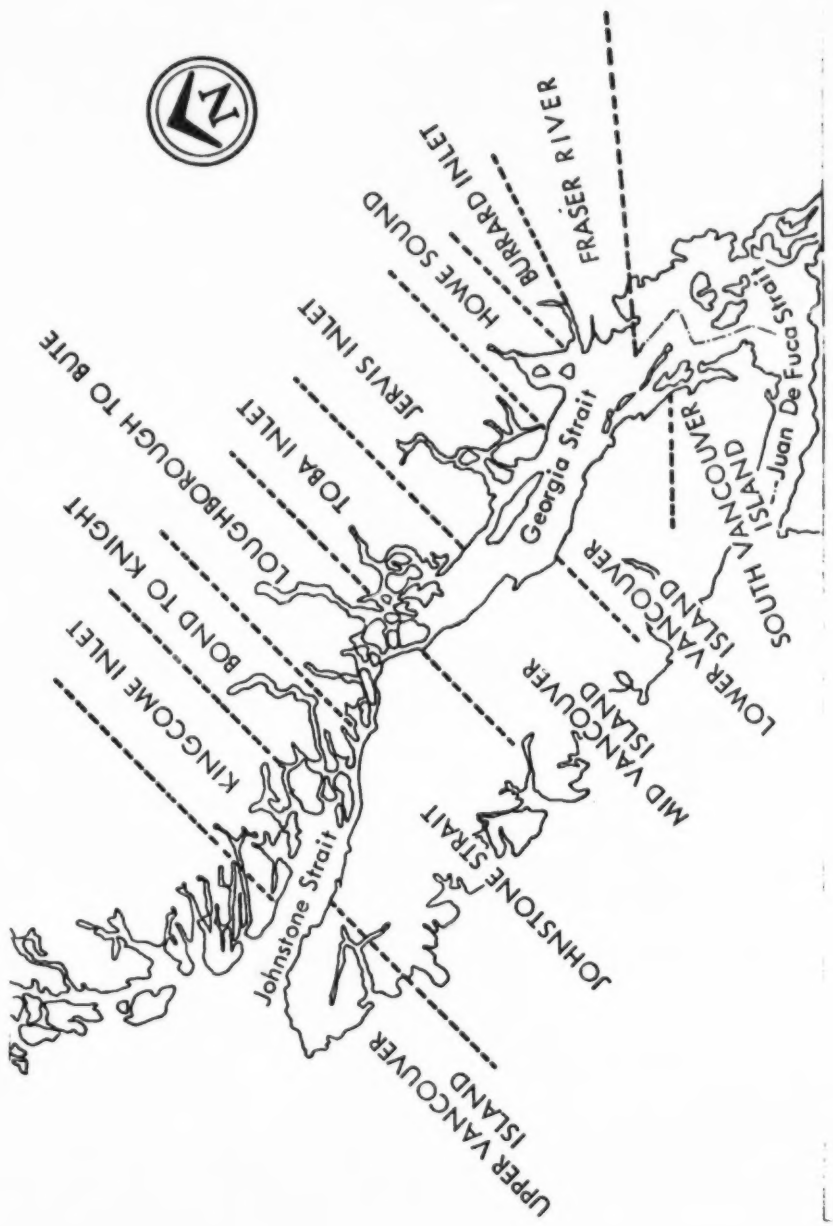


Fig. 2. The Johnstone Strait-Fraser River chum salmon Study Area.

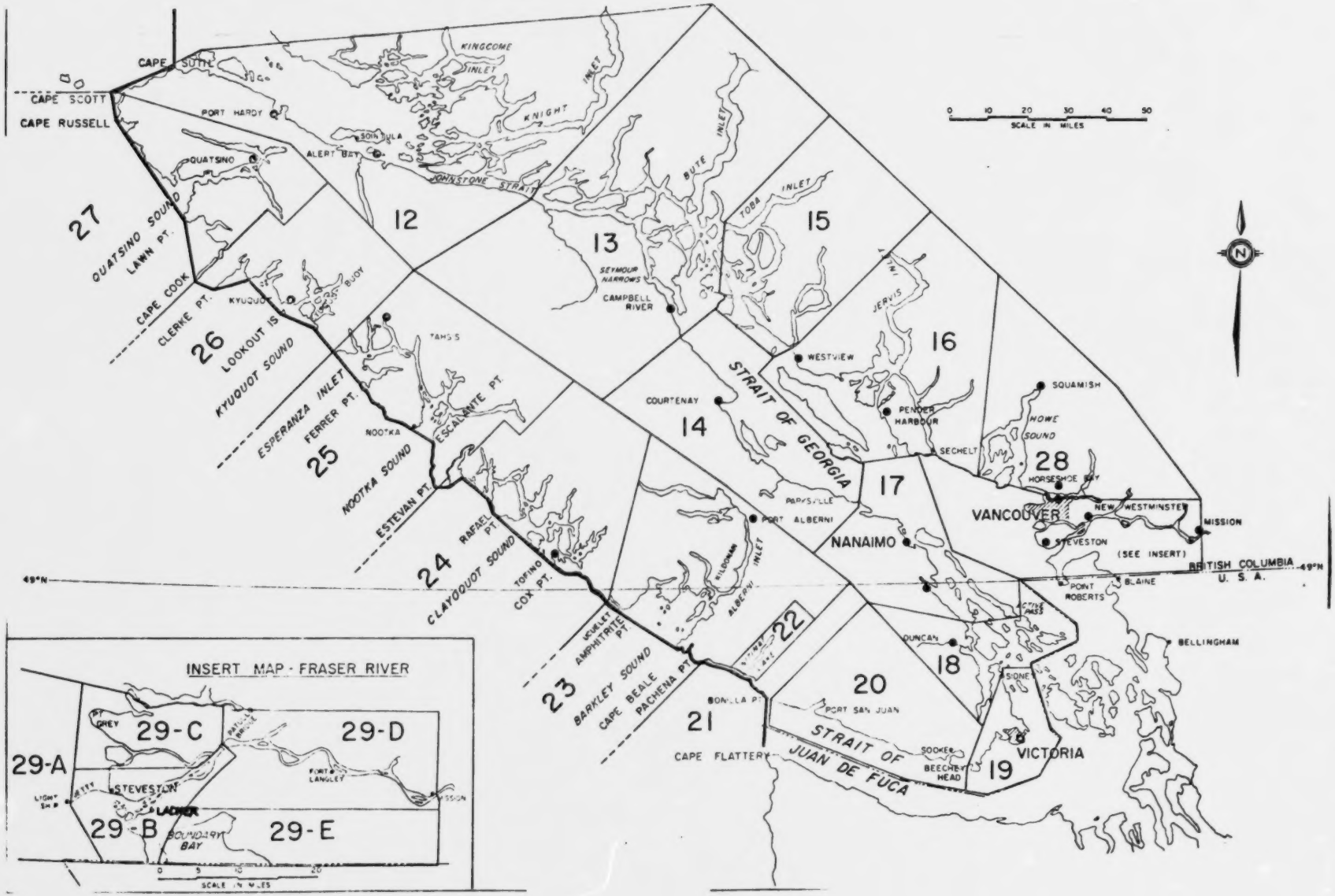


Fig. 3. Statistical areas of catch for southern British Columbia waters.

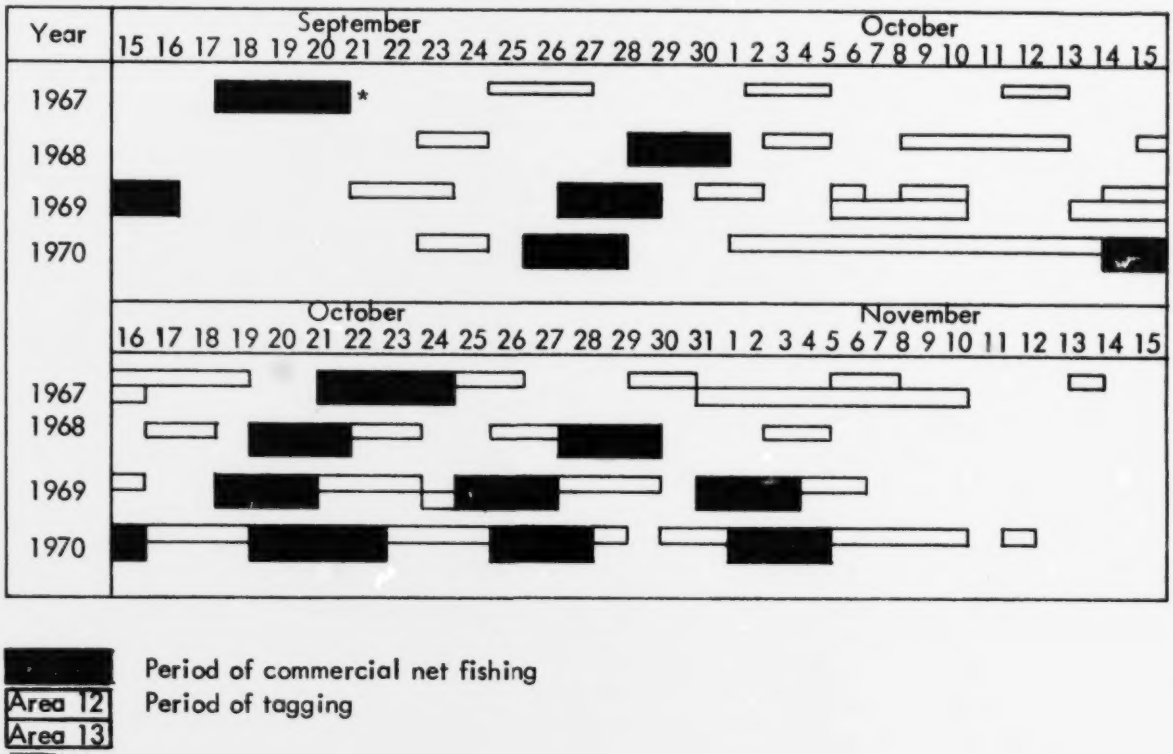


Fig. 4. Occurrence of tagging and commercial net fishing periods in Johnstone Strait (Areas 12 and 13) during 1967-1970.

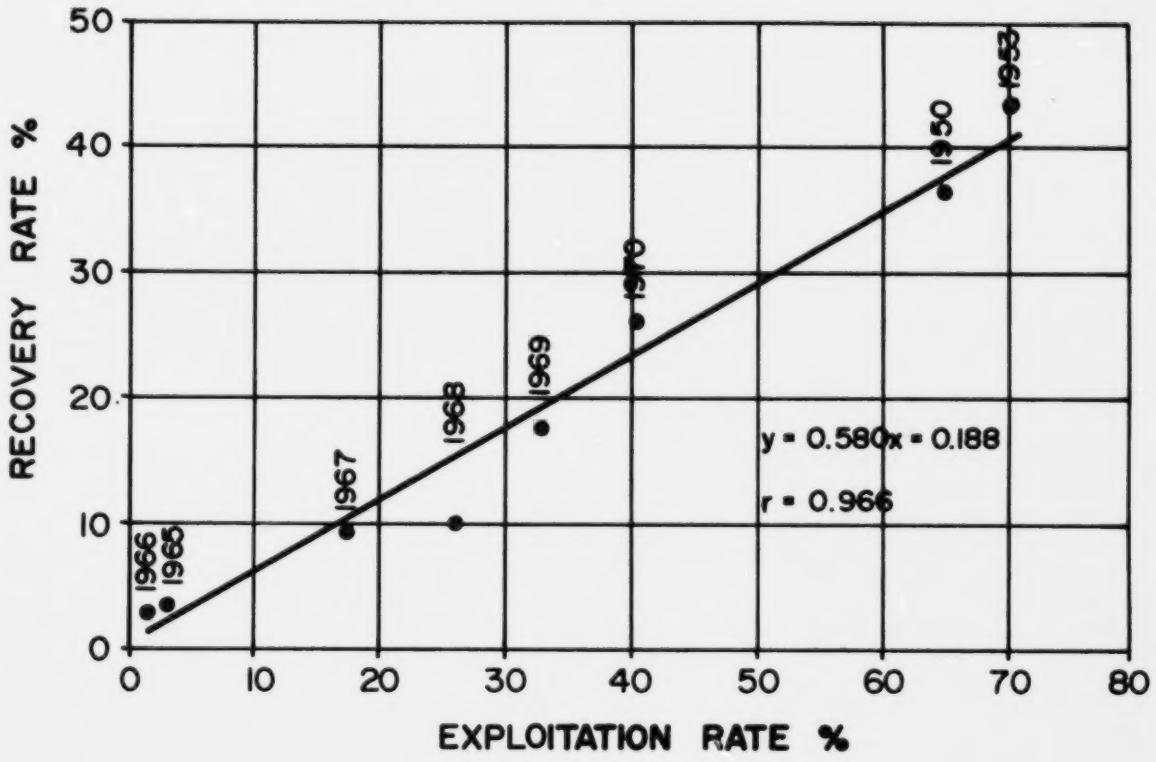


Fig. 5. The relationship between exploitation rate and recovery rate of tagged chum salmon in the commercial catch for tags applied in upper Johnstone Strait.

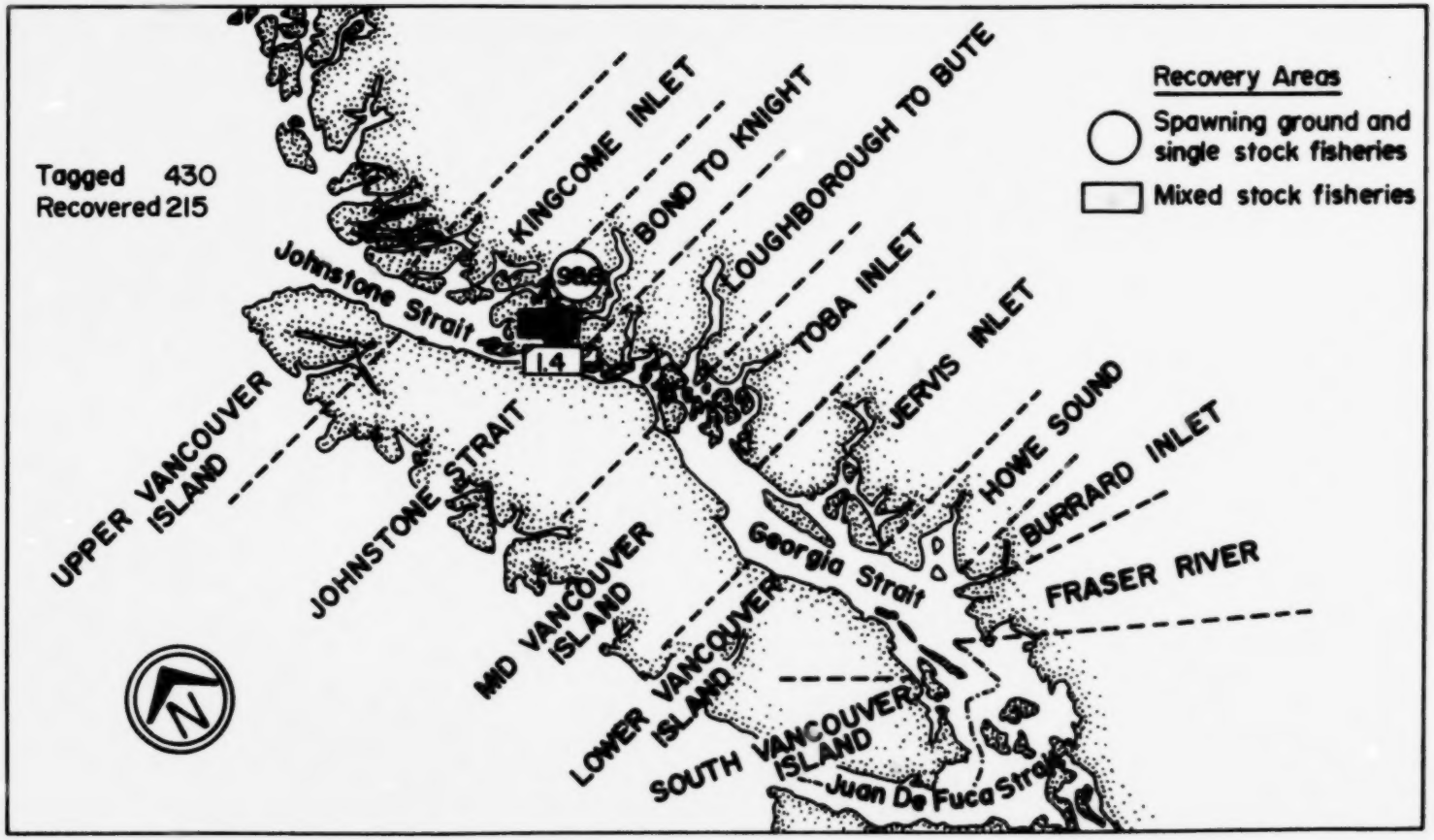


Fig. 6. Distribution (percent of total recovered) of chum salmon tagged in Bond to Knight inlets during July and August, 1968-1970.

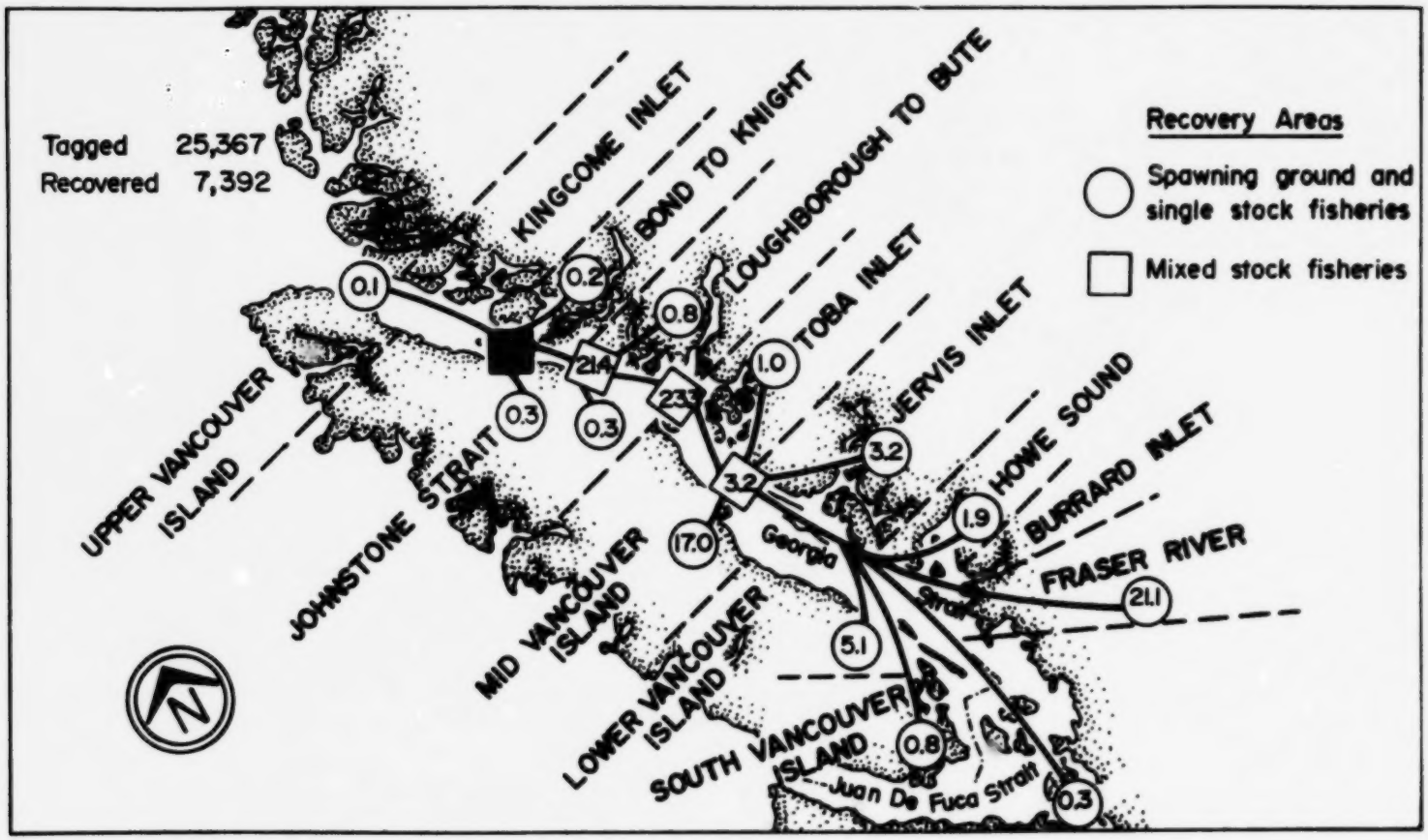


Fig. 7. Distribution (percent of total recovered) of chum salmon tagged in upper Johnstone Strait during September to November, 1965-1970.

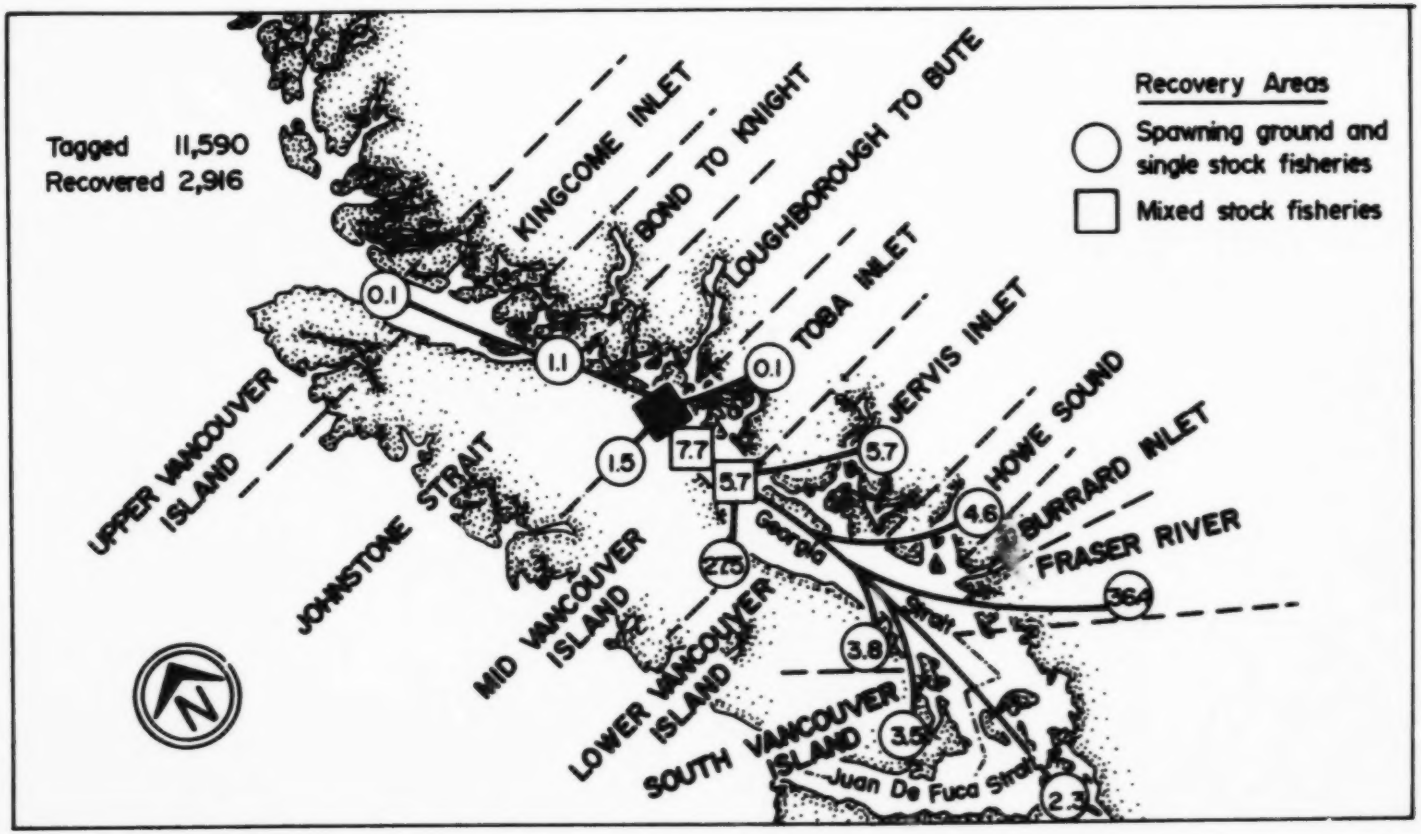


Fig. 8. Distribution (percent of total recovered) of chum salmon tagged in lower Johnstone Strait during September to November of 1962, 1967, and 1969.

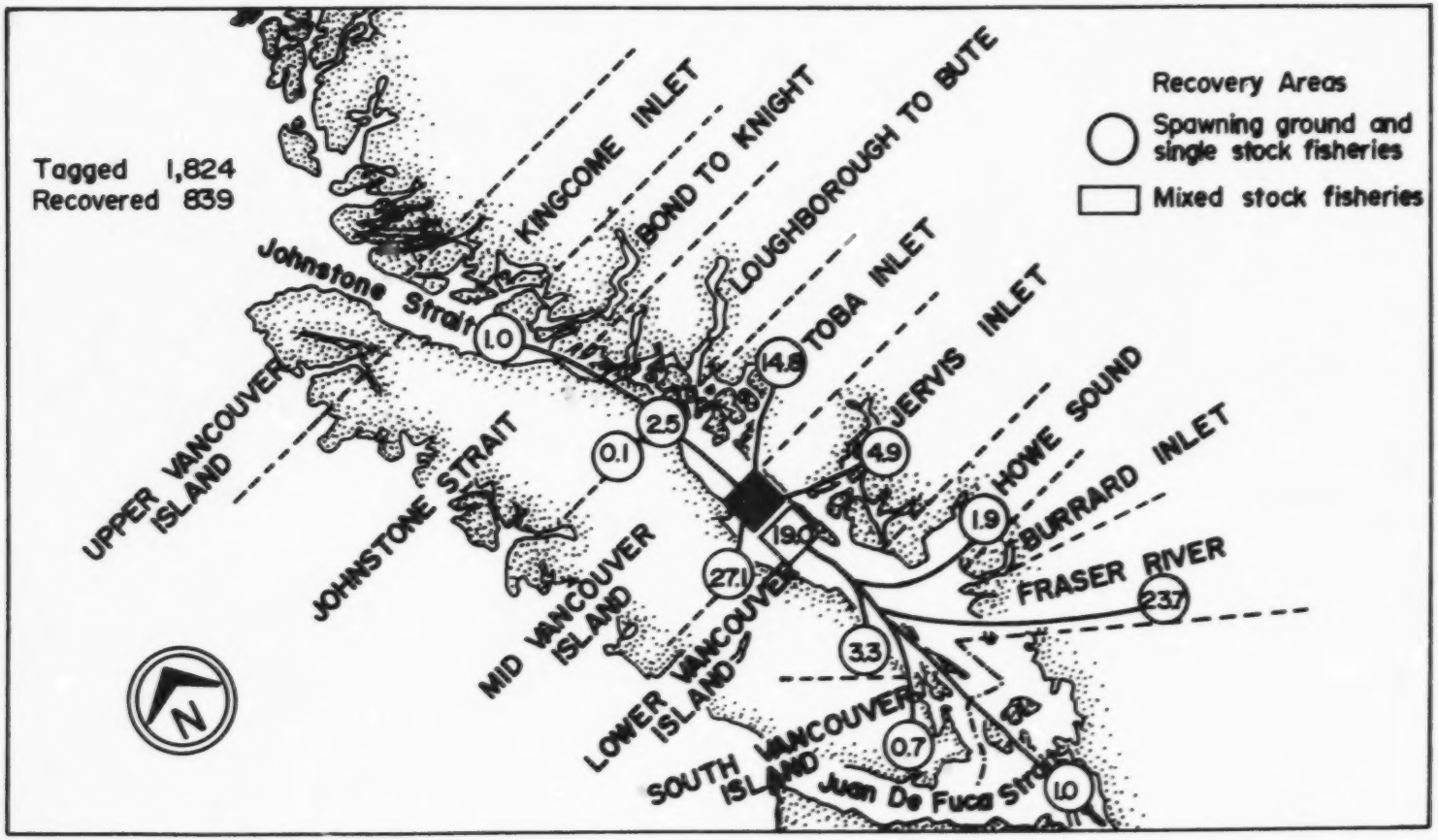


Fig. 9. Distribution (percent of total recovered) of chum salmon tagged at Texada Island during October to November, 1970.

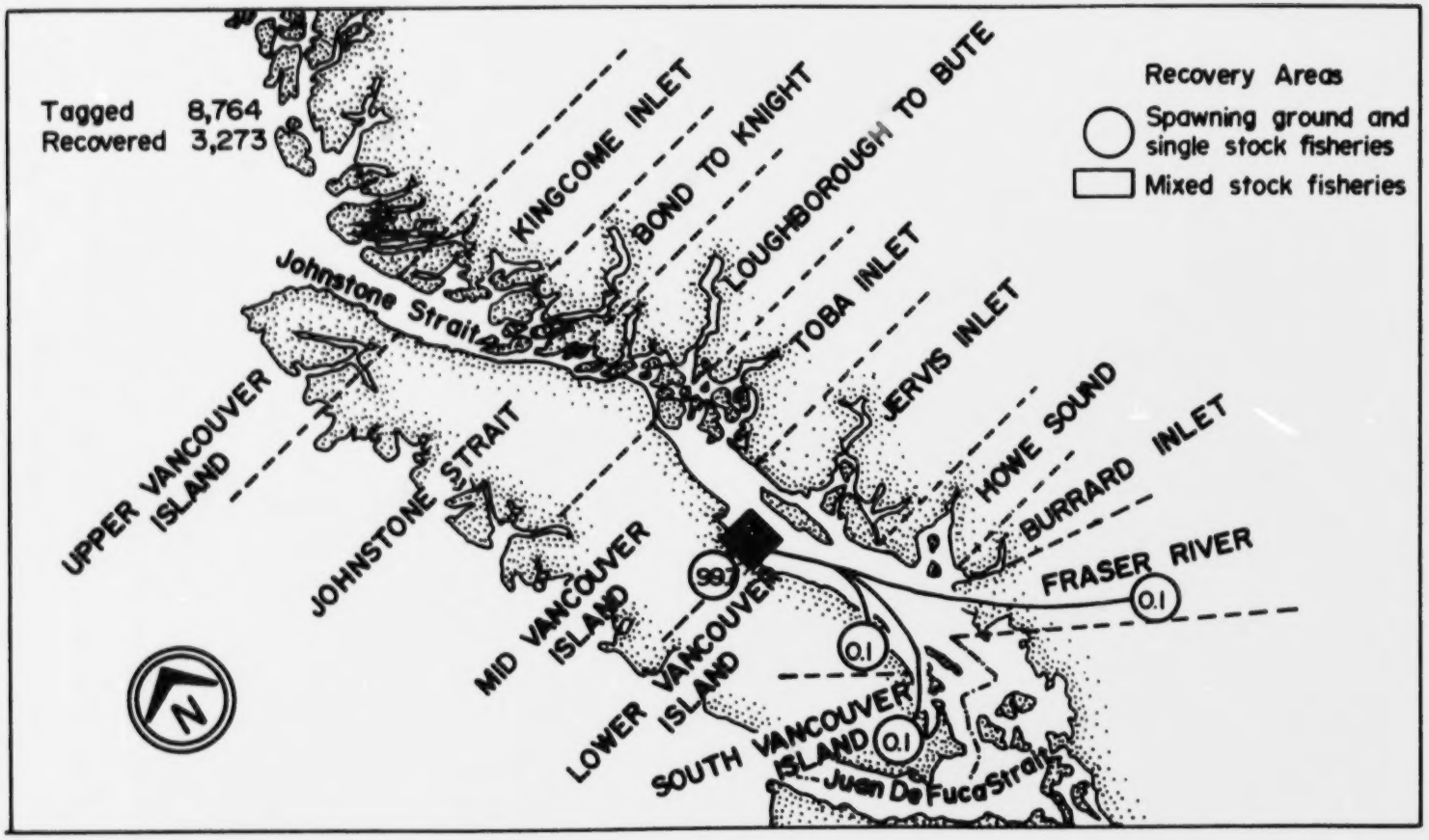


Fig. 10. Distribution (percent of total recovered) of chum salmon tagged in Qualicum to Baynes Sound during October and November of 1967 and 1969.

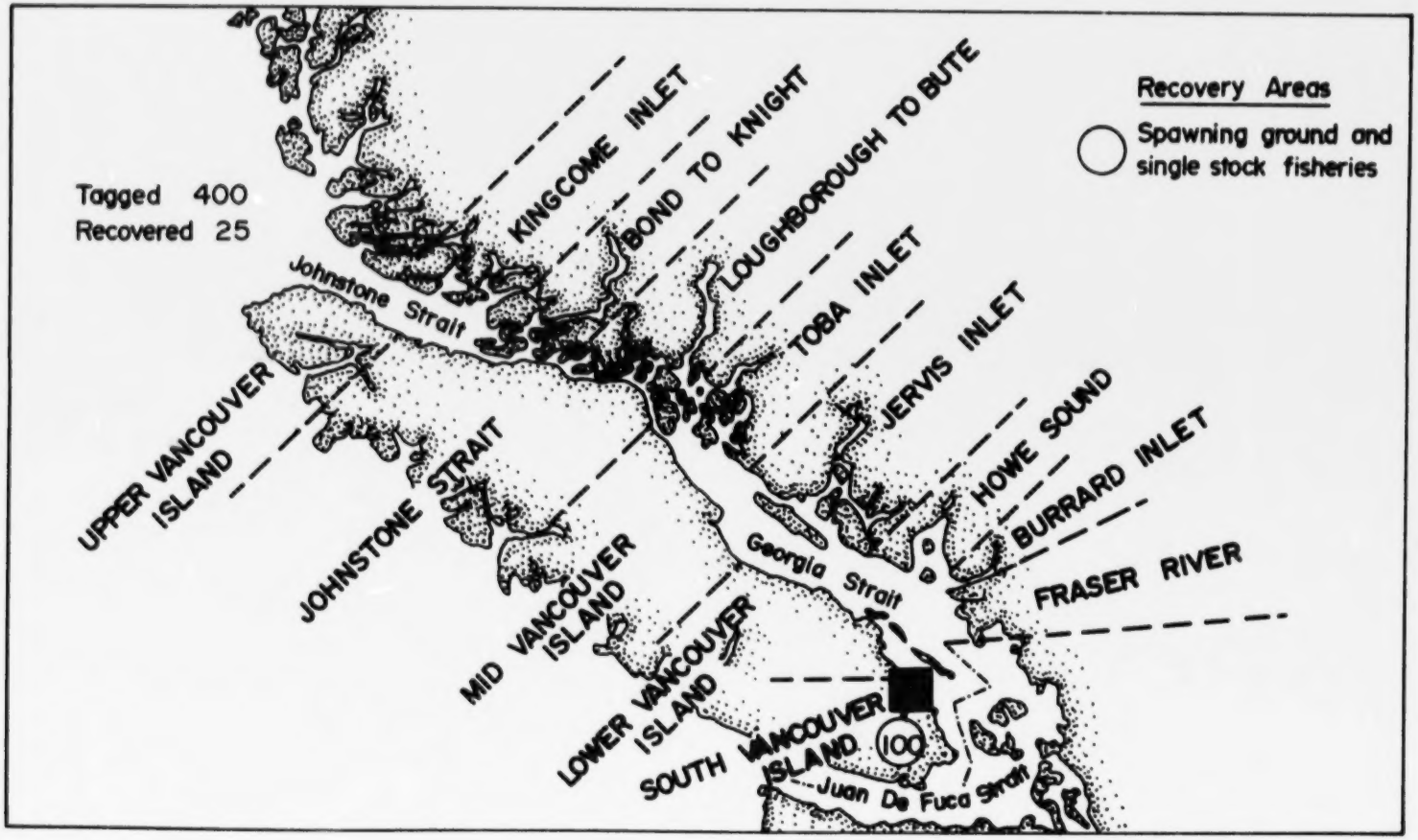


Fig. 11. Distribution (percent of total recovered) of chum salmon tagged in Cowichan Bay during November 1969.

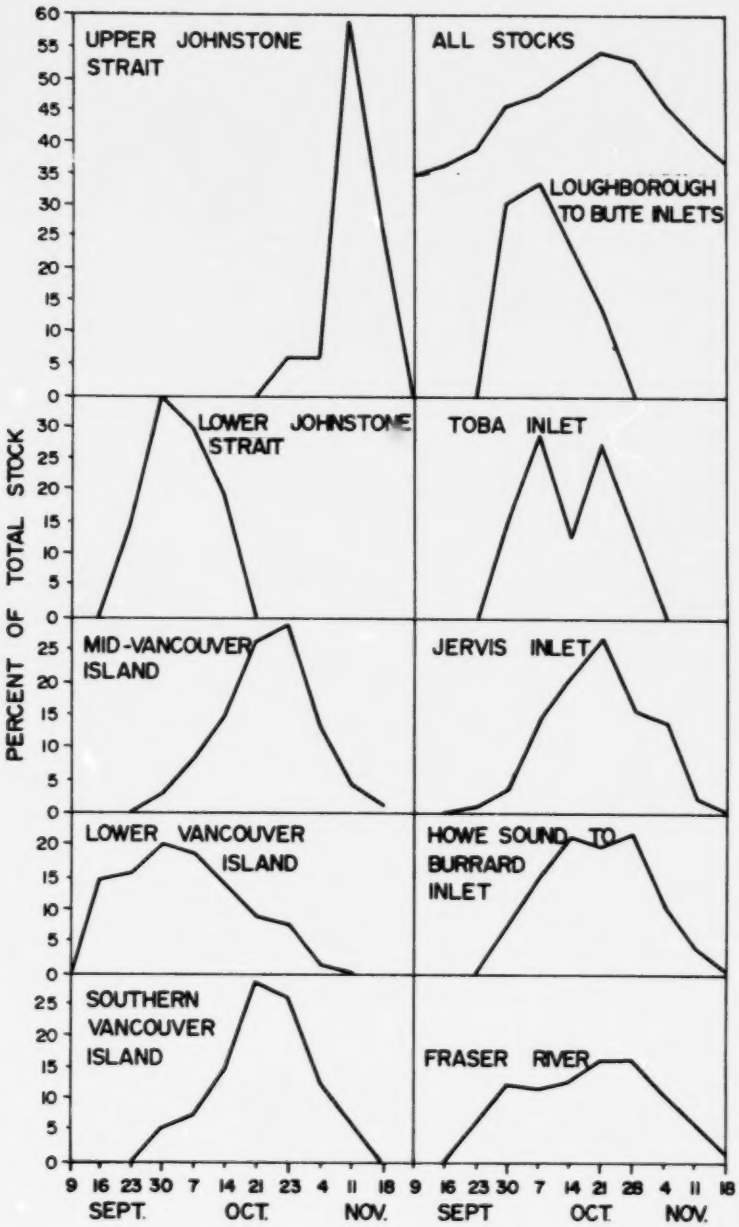


Fig. 12. Percent abundance of chum salmon stocks entering upper Johnstone Strait for week ending as indicated on figure.

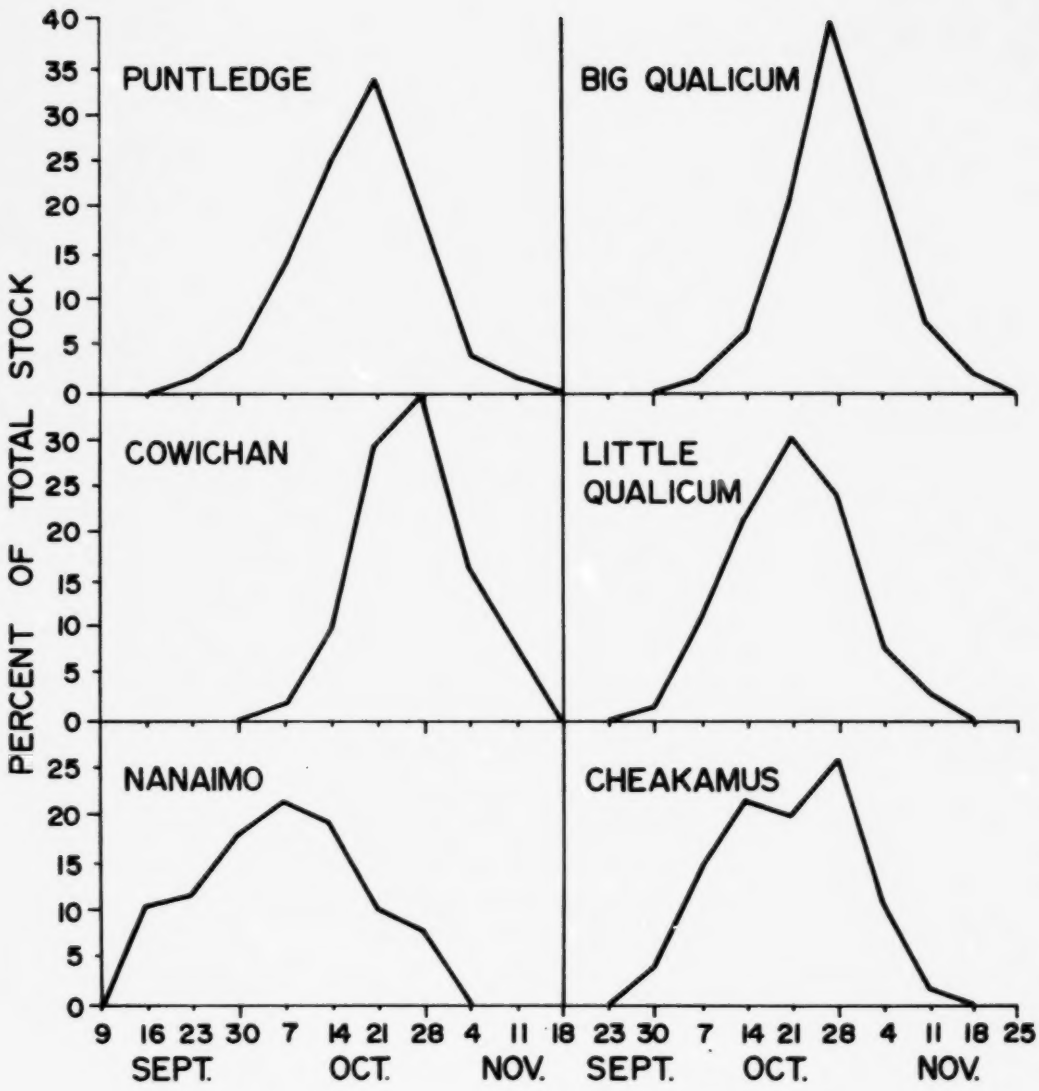
PUNTLEDGE
BIG QUALICUM
COWICHAN
LITTLE QUALICUM
NANAIMO
CHEAKAMUS
PERCENT OF TOTAL STOCK
0 5 10 15 20 25 30 35 40
9 16 23 30 7 14 21 28 4 11 18 23 30 7 14 21 28 4 11 18 25
SEPT. OCT. NOV. SEPT. OCT. NOV.

Fig. 13. Percent abundance of chum salmon populations entering upper Johnstone Strait for week ending as indicated on figure.

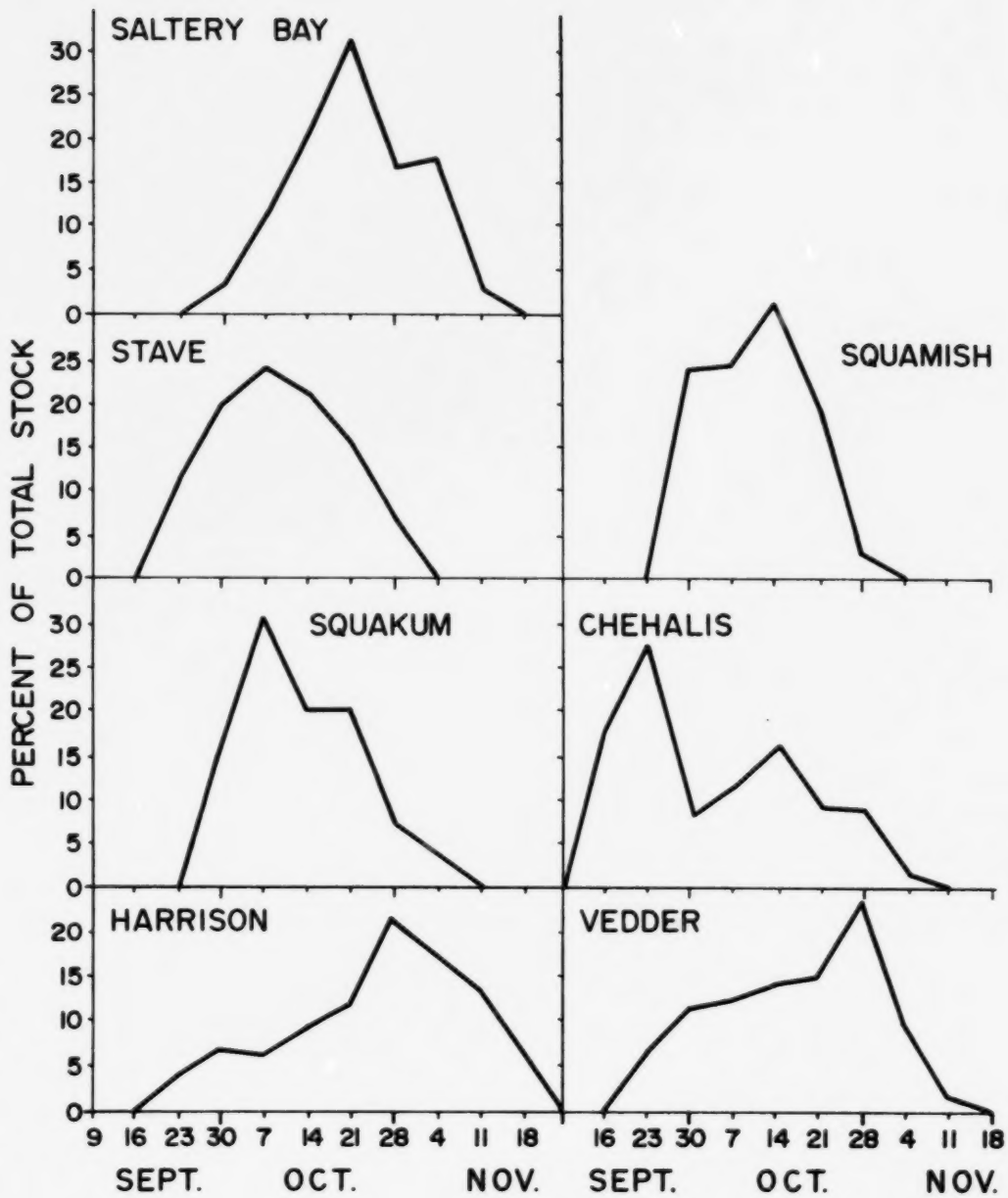
SALTERY BAY
STAVE
SQUAMISH
SQUAKUM
CHEHALIS
HARRISON
VEDDER
PERCENT OF TOTAL STOCK
0
5
10
15
20
25
30
9 16 23 30 7 14 21 28 4 11 18
SEPT. OCT. NOV.

Fig. 13. (cont'd)

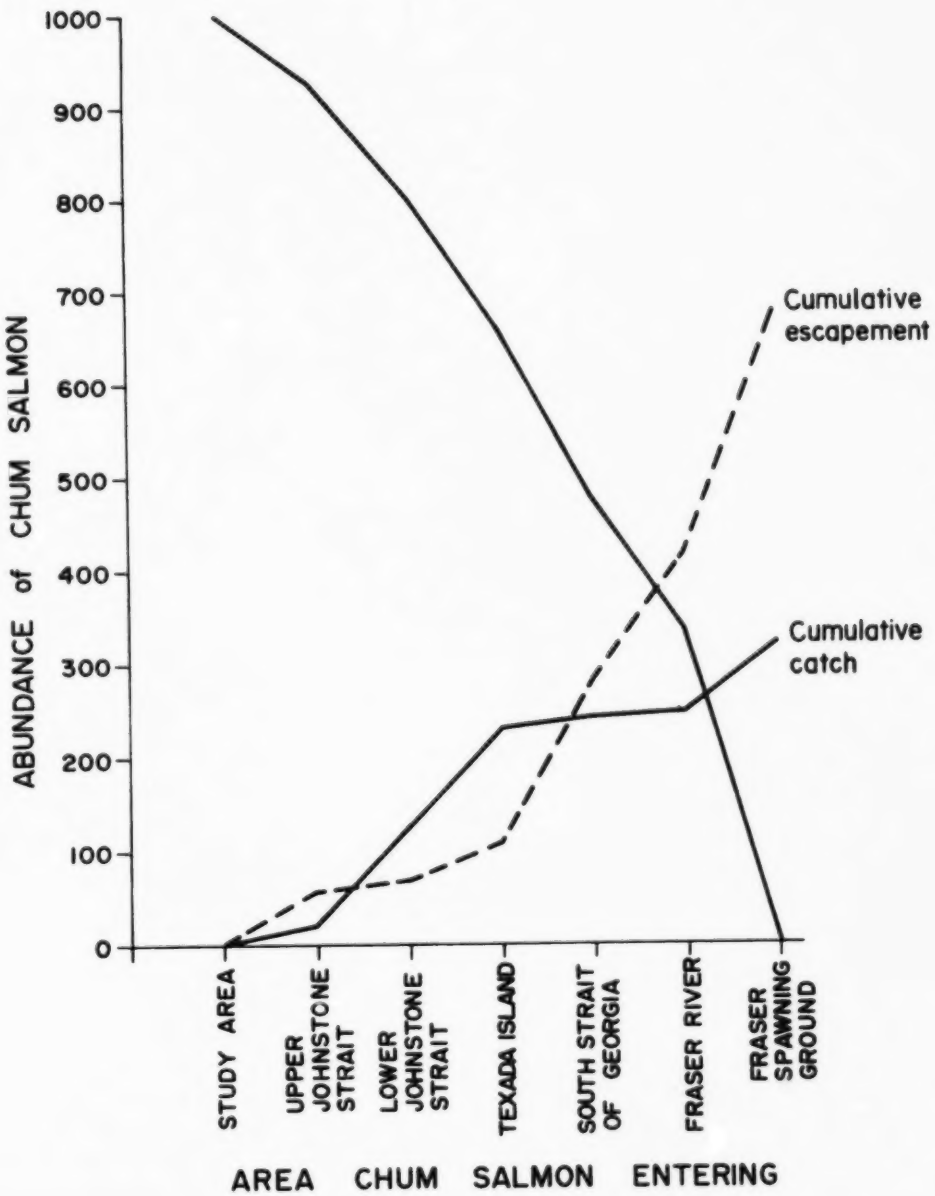


Fig. 14. Relative abundance, cumulative catch, and cumulative escapement for chum salmon entering the study area.

POOR

QUALITY

ORIGINAL